FLYING

AND POPULAR AVIATION

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E MUST 'FREEZE' OUR AIRCRAFT DESIGNS

By SENATOR HARRY S. TRUMAN

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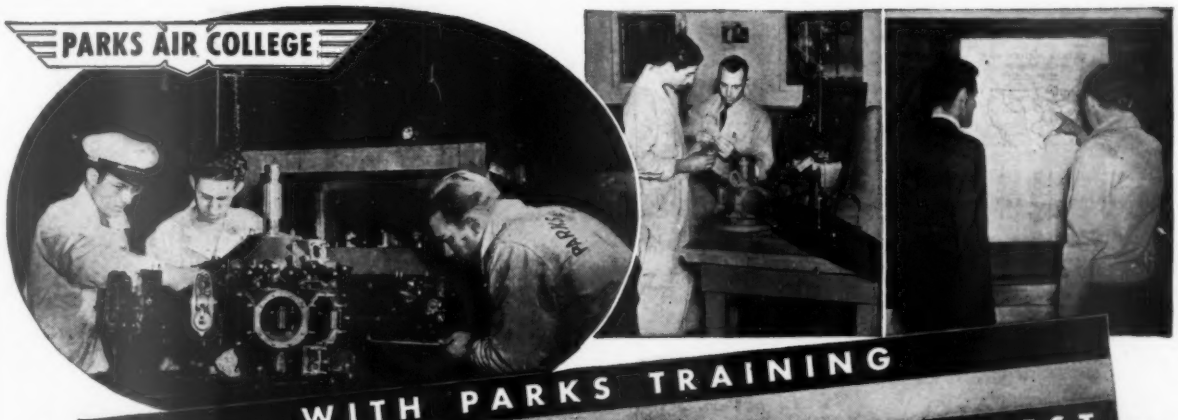

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WE just were on the verge of writing another one of those "where-the-hell-are-the-airplanes-in-this-war?" editorials when it dawned on us that it would take a half dozen columns this size to do a sensible job of it. Besides, so many authorities and would-be authorities already have sounded off on the subject that we don't feel we should add to the din at this time. All we *can* justify saying is that we wrote in anticipation of Singapore, Crete, the *Prince of Wales* and *Repulse*, Pearl Harbor and the Philippines two years ago. Now that these terrible tragedies have come about, we can only hope the same mistakes won't be repeated. American aircraft industries are turning out the world's finest fighting planes at high speed. We pray they will be given a chance to show the world just how all-powerful air power really is.

* * *

IF you have any notions that aircraft silhouettes and elaborate identification materials are so much gingerbread, well, stop helping our enemies and get to work. Silhouettes are a vitally important phase of modern aerial warfare. Pilots study them so that they can tell a plane of theirs from an enemy at a split-second glance. But, most important, civilians on the ground will have to bear much of the burden of quickly spotting enemy aircraft from their own, and reporting them to headquarters as fast as possible. The ability to do an even passably accurate identification job rests solely on the spotter's use of silhouettes for study and practice. Relatively few people—even spotters—ever see enemy aircraft often enough or close enough to study them at their leisure. Silhouettes are their only source of information. So make it your business to study all silhouettes you can lay hands on—but be sure they are authentic and accurate. Every little curve means something, just as a slight variation in the design of a fender may help you differentiate between a Ford and a Chevrolet.

* * *

ANYONE interested in seeing a madhouse without having to go to one licensed by the state, well, come on up and see us. We thought things hummed around deadline time before the war; now we know it was a Ladies' Aid meeting compared to what it now is. We're writing this at almost the very minute this issue must leave this office to go to press. Corrections and new additions arrived just this afternoon from Charles Stanton for his article on page 23. More material arrived this morning from Leonard Engel (page

(*Continued on page* 113)

FLYING
AND POPULAR AVIATION
Trade Mark Registered
Volume XXX Number 4

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Aviation has JOBS for thousands but CAREERS only for trained men!

The tremendous responsibility of aviation in America's war effort has made it possible for thousands of men to obtain semi-skilled, single-phase jobs in the aircraft industry through cheap "quickie" courses. BUT—the only man who is ESSENTIAL to the industry is the man with the long-range training to fill any of the important supervisory positions to which he may be assigned. Only by such training can YOU be unquestionably designated as ESSENTIAL to vital war production—and continue to be essential to the industry through the readjustments that must follow when war production shifts back to peace time schedules. Only the Career man is essential to aviation!

The executives who have made aviation THEIR career want only those men with the intelligence and sincerity to select aviation as a life work and to adequately prepare themselves for it by proper training. They know that the value of each man is largely determined by the ability and experience of those who train him for his career. And they know that Curtiss-Wright Technical Institute graduates are—and for many years have been—precisely trained to fill the industry's exacting requirements.

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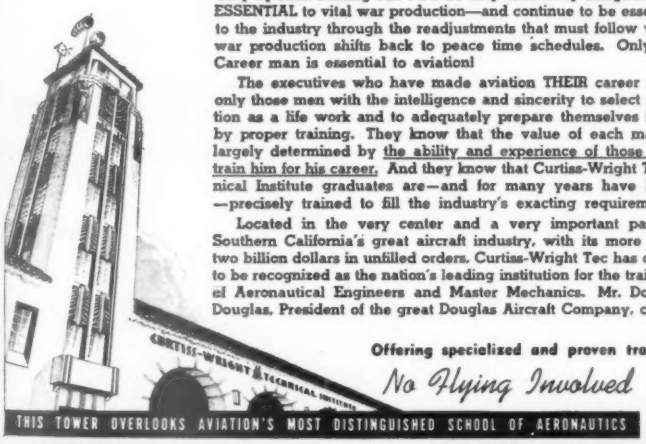

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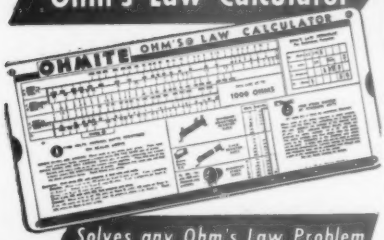

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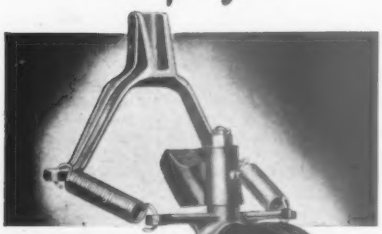

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Letters

Thanks

Sirs:

I have just read my first copy of your great magazine obtainable since the war began. Englishmen are hard to please, but I can honestly state that my friends and I find it difficult to say which is the best, your own journal or the excellent English publications on aviation.

If there is any one of your readers who has any back numbers he would like to send across (the Air Forces issue would be especially welcome) he would earn the sincere gratitude of an air-minded Britisher.

I would also like to pass on the warm thanks of millions of Britishers for the splendid machines you Americans are sending here in ever increasing numbers . . . and the famous Eagle Squadrons of our Fighter Command.

W. PRAGNELL
"Alistair"
Collin Road
Taunton
Somerset, England.

Correction

Sirs:

We look forward to your magazine . . . each month, but wish to point out an error in the February issue. In the caption regarding Flight Sgt. Nowell you refer to him as Sgt. Nowell, when the photograph shows clearly the crown upon his arm . . . you inform your readers he has been decorated with the DFC with bar . . . the DFC is only presented to commissioned officers and since Flight Sgt. Nowell is an NCO we think you mean the DFM and bar.

TWO SERGEANT OBSERVERS
RAF Station
Picton, Ontario, Canada.

From Brazil

Sirs:

. . . Several years ago Brazil promulgated a new Air Code . . . in an understandable effort to promote its own commercial aviation, the Air Code contained a provision which restricted the piloting of aircraft to native-born Brazilian citizens . . . It was thought by many people concerned that the intention was to apply this provision to commercial aviation only . . . However, the legal department of the Air Ministry issued an opinion that the law applied to private as well as to commercial flying . . . As the situation now stands, flying in any form without a National Department of Aeronautics' license is forbidden and the holding of such a license is limited strictly to native-born Brazilian citizens.

There are a number of Americans in Brazil such as myself, representatives of American business interests . . . who hold American private licenses and fly for both pleasure and business. To us, the application of such restrictions to private flying has little more justification than applying them to automobile driving . . . The situation is a little delicate inasmuch as . . . under present circumstances, neither Brazil nor the United States would be anxious to throw private flying wide open to the citizens of all countries. However, there is little reason why, in accordance with precedents established in other lines, reciprocal licensing of citizens of the American republics should not be permitted and encouraged . . . The United States has done much . . . to promote the growth of aviation in Brazil . . .

GEORGE N. BAUDIN
Ingersoll-Rand S. S.
Rio de Janeiro, Brazil.

Dilemma

Sirs:

. . . I am enclosing a picture of myself and my Taylorcraft, taken December 28, 1941, which I believe tells the complete

story of private flying on the Pacific coast since December 8, 1941 . . .

VERN WEST
Alhambra, Cal.

● Perhaps Reader West can get his wings back with the help of the Civil Air Patrol.—Ed.

Service

Sirs:

. . . With reference to "We Pilots Want Service" . . . you comment that you do not necessarily agree with Mr. Churchill's views . . . I agree with them entirely . . . If you do not . . . it is probably due to the fact that you have not had as much experience in getting around the country in a lightplane as he, which is not any discredit to you or your opinions in the least . . . You have a great magazine and deserve a lot of credit . . . The Army issue was a masterpiece.

SMITH H. LAPSLEY
Tulsa, Okla.

Recruits Needed

Sirs:

. . . One of the most important contributions of this agency to the war effort will be our recruiting and organizing of aviation mechanic-learners in the several

(*Continued on page* 84)

ONLY 12 MONTHS TRAINING WINS $250 A MONTH POSITION

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Instrument and Radio Beam Flying ☐ *Master Mechanics* ☐
Instrument Technician ☐

Name_____ Age_____

Address_____

City_____ State_____

The Birdmen's Perch

Say, would one of our West Coast readers check on a rumor we've heard? Does the Army really send up a pursuit squadron each morning to patrol the wings of the B-19 and chase away any homesteaders who have staked out claims during the night?

Major Al Williams, alias "Tattered Wing Tips,"
Gulf Aviation Products Manager, Gulf Bldg., Pittsburgh, Pa.

FUNNYBONER DEPT.

Some of you old-timers may remember this story. It's one a well-known test pilot used to tell on himself:

This hot-shot was making a cross-country demonstration of a brand-new service ship one day when his passenger, a Navy brass hat, suggested lunching at his farm in Connecticut.

An hour later they'd picked up the farm and the pilot looked nervously for the field the Navy man had promised. The brass hat pointed to a lawn size bit of

grass with trees at both ends. Even after they'd souped down to 200 it didn't look much bigger than a ten-cent handkerchief. "Hey! I can't get in there!" protested the pilot, indignantly.

"Guess we'll have to eat elsewhere," the brass hat said, shrugging his shoulders. "But I've done it myself."

That's where the pilot got mad! Nobody with grey hair could outfly him!—

After four approaches he mushed in, clipping leaves from the trees with his tail-wheel. The trees at the far end of the field rushed at him as he used all the brake he dared. The prop was mere inches from a husky evergreen when the plane finally stopped. The test pilot unhitched his belt, stumbled out onto the grass and swallowed his heart. "Say, are you *sure* you've set down here?" he blurted.

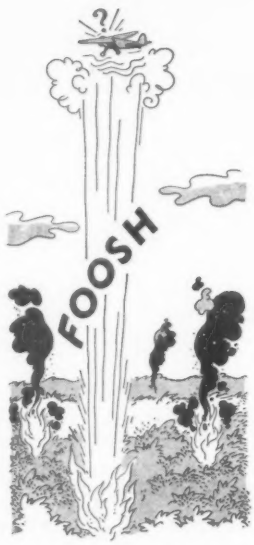
"Certainly!" the BH answered. "In a Curtiss pusher, twenty five years ago."

Light dawned on the hot-shot as he compared the 30mph landing speed of the antique with the 70-odd mph at which they'd just landed in the service ship. "And those trees?" he asked weakly.

"Golly, I guess they were just bushes then," laughed the Navy man.

THIS MONTH'S BRAIN TWISTER

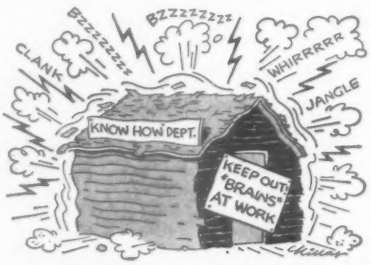
Three planes simultaneously entered a bank of fog ten miles wide. The planes, a P-38, a PBY, and a Cub had speeds of 400 mph, 200 mph, and 95 mph respectively. How far into the fog did each ship fly?



KNOW HOW TO KNOW "KNOW-HOW"

We hear the phrase "know how" more and more these days. We'd define "know-how" as an extra knack, a special sort of ingenuity that turns out 215 training-plane engines a month from a factory with a capacity of 195, or cuts the time necessary to shape a laminated spruce wing spar from 24-man hours to 20 minutes flat.

We don't claim any corner on "know-how" at Gulf. But we do feel that we've got more than our share. An example is the way our research men just wouldn't admit that ordinary refining methods made a lubricant efficient enough and dependable enough for airplane engines. Refin-



ing formulae to the contrary, they thought that there MUST be a way to make a better, safer oil.

There was!

They used pencils, paper, and slipsticks; they used the laboratories; *they used* "*know-how*." And they developed the special Alchlor process which gets MORE of the carbon and sludge making impurities out of Gulfpride and makes it the better, safer oil they wanted.

THIS MONTH'S WHOPPER

Sir:

I have read with amazement the articles which have appeared in your columns. I have accepted the truth of the findings of obviously sincere and honest pilots and explained their contradictions as from inadequately standardized observations.

This field experience under conditions which eliminate most of the observation errors may interest you.

On a cross-country flight in Florida my engine cut out. The ground beneath was covered with a heavy growth of palmetto and scrub pine and, directly under me, one of many brush fires. To prevent an explosion I started to pump the Gulf Aviation Gas from my tanks as I spiraled down for a forced landing. The first pint fell into the fire. The resulting rapid oxidization of this unusual hydro-carbon created a thermal which carried me to 8,500'.

Using sail-plane technique, I glided several miles to the next grass fire and repeated the operation, thus continuing to my destination. Careful observation of the ground evidenced the phenomenal heat released by the G.A.G. Otherwise impenetrable jungle was cleared by the complete burning of the heavy growth, including stumps and roots.

The extreme speed of these G.A.G. reactions, as predicted by theoretical physicists of space-time relations, even disturbed my normal time concept, for as I glided the native woodmen were already erecting fences and setting out gardens and groves of citrus trees. Now, on flying this same course, many of these isolated farms are seen to be the homes of happy people.

Sincerely yours,
"Doug" Moore
St. Petersburg, Fla.

Gulf Oil Corporation and Gulf Refining Company . . . makers of

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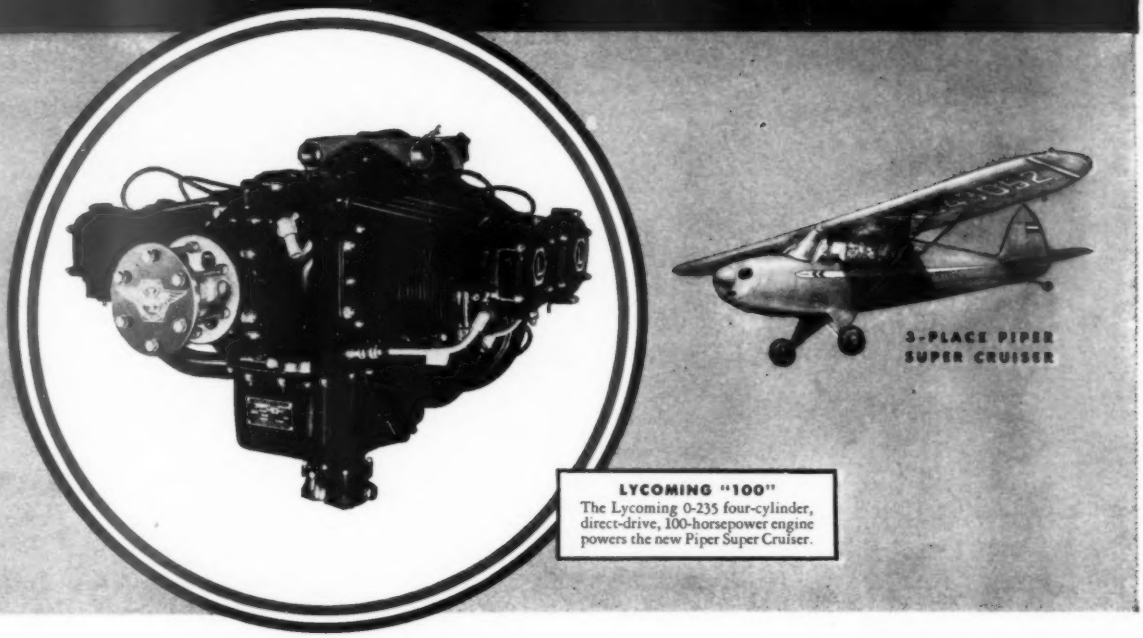

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You are the man who can fit best into the key jobs of aircraft engineering, production and maintenance . . . into the work of creating the designs for our fighting planes . . . or doing the more important types of mechanical and technical work . . . or supervising the work of others. You are the man who can advance to the responsible supervisory and executive posts of the great peace-time aviation industry ahead . . . secure in a profitable, satisfying lifetime career.

You are the man who can make BEST USE of the outstanding type of aeronautical training given by Aero Industries Technical Institute. Engineering . . . aircraft production . . . airplane and engine maintenance . . . whichever holds greatest interest for you . . . at Aero Tech you will get training that is best for you, best for your country . . . training in the ONLY aviation school under direct executive management of top-ranking aircraft industry executives.

If you build model planes

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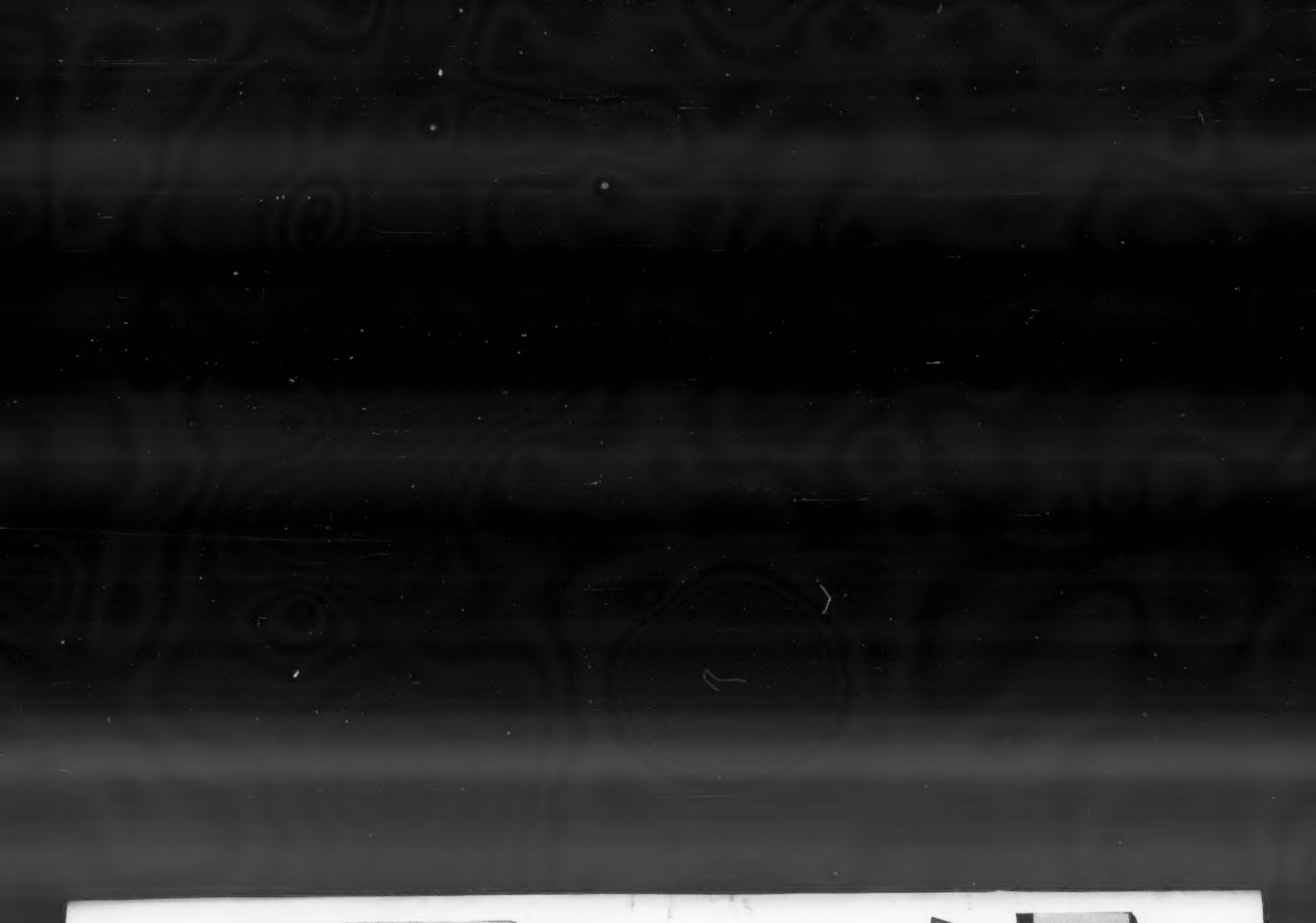

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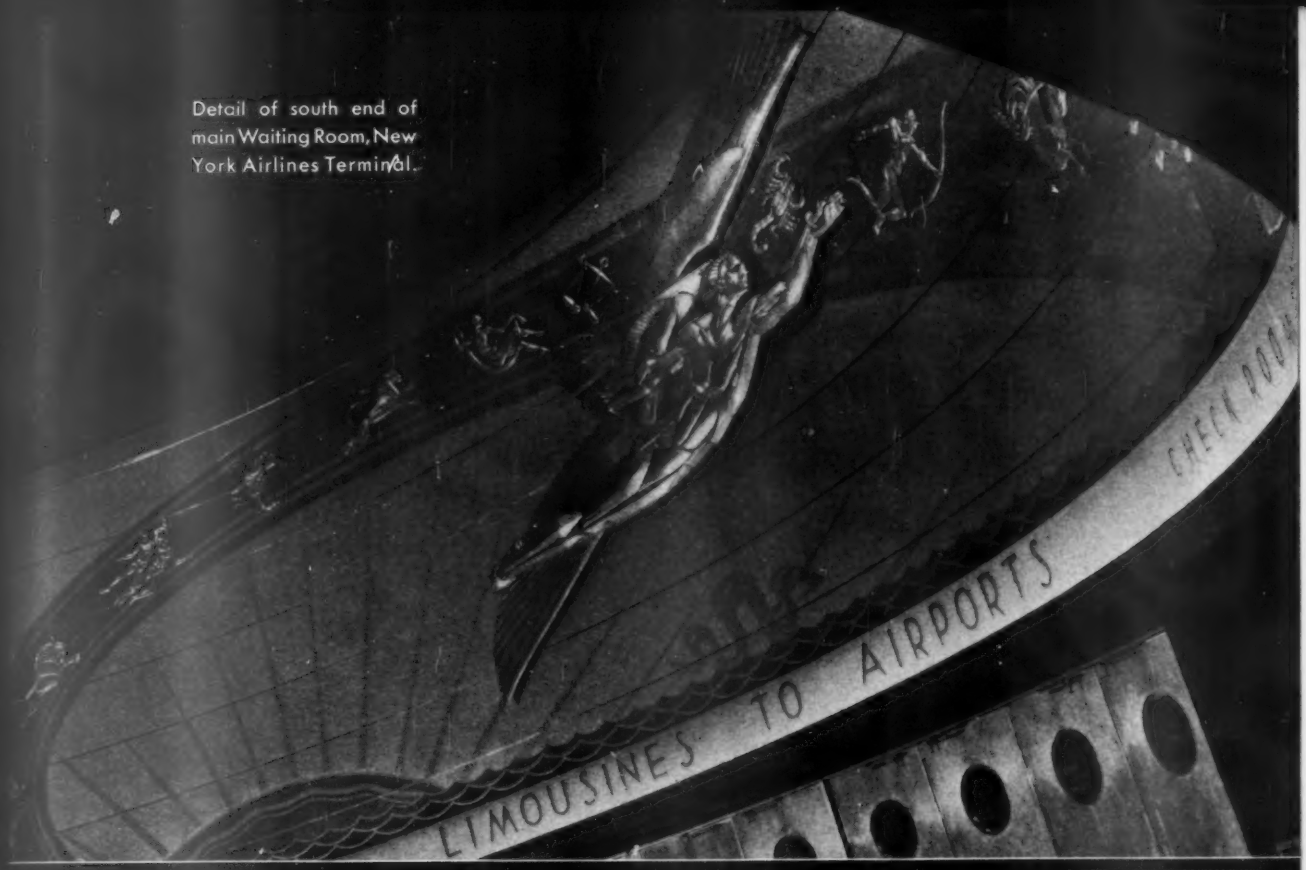

Detail of south end of main Waiting Room, New York Airlines Terminal.

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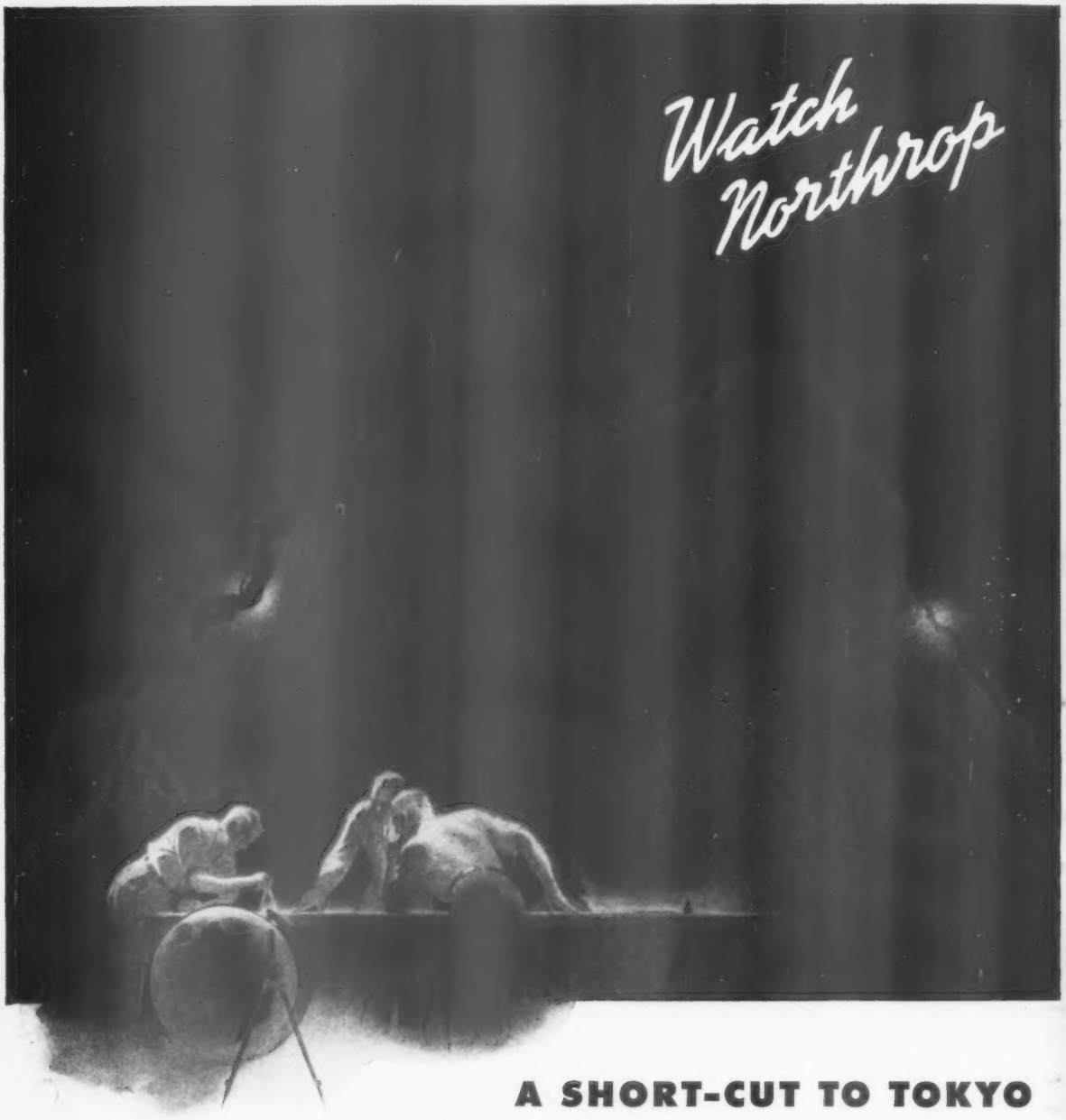

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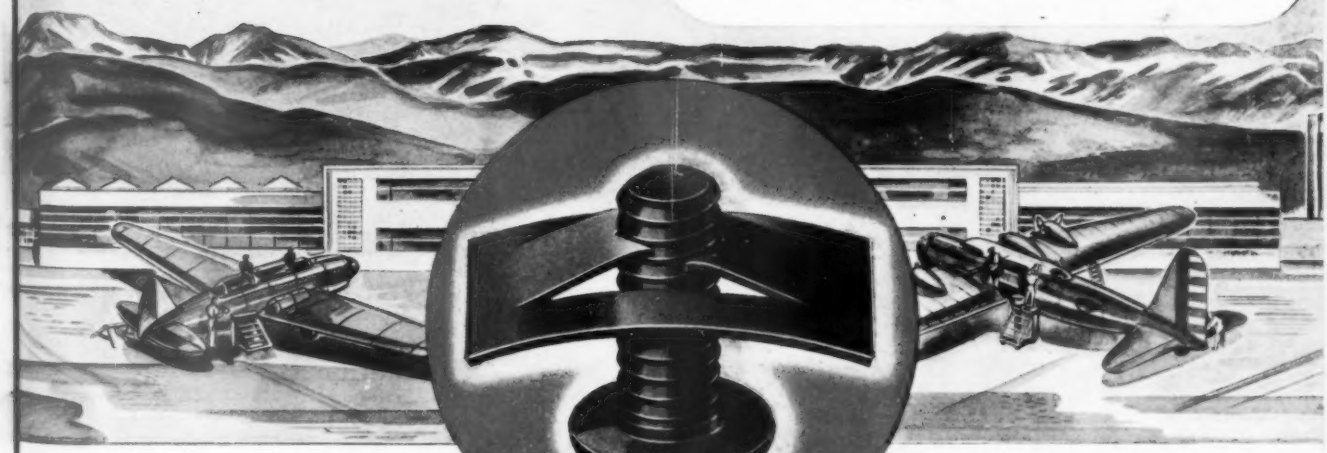

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Once standardized, the author contends, production on these Lockheed P-38's can be greatly speeded up.

We Must 'Freeze' Our

Chairman of the Senate Committee whose report he here analyzes, Senator Truman presents his own views and conclusions as to remedial steps necessary to further the National Defense program. Congressional committees, if they perform a job not otherwise taken care of in executive agencies, often are helpful. In World War I, investigations such as that made by the Truman Committee did not come until after the war. It may be significant that one day before the Truman report was made public the President recognized the lagging production situation and appointed Donald M. Nelson as the country's war production chief. Whether Mr. Nelson's policies will follow the lines suggested in the accompanying article remains to be seen. Many within the industry feel that Senator Truman did not put his finger on the trouble; that the causes for delay are much more fundamental. Meantime, production goes on apace. Some subcontractors have far exceeded their own expectations and promises. With time so precious and airplanes so vital, the questions raised by the Truman report must be handled intelligently, but without interruption of what is now going forward.—Ed.

THE answer is a rather obvious "yes" to the question: "Shall we standardize or 'freeze' our military aircraft designs so as to speed up production?" We can have no real mass production to meet our staggering war needs without standardizing types and without freezing of basic designs for periods sufficiently long to make production methods effective.

That conclusion was reached by the Senate's special committee investigating the National Defense program (Truman Committee), after months of intensive inquiry. It must be followed as a guiding principle if the hope of attaining the national war goal fixed by President Roosevelt (60,000 planes of all types this year and 125,000 in 1943) is to be realized.

Without sacrificing quality, the objective can be reached provided our national genius is fully applied and some dangerous official methods and policies and attitudes are revised.

Mass output by freezing basic designs to an effective degree raises enormous and well recognized difficulties. The airplane is still in process of evolution as both a means of flight and weapon of war. If no changes in design whatever were permitted advances would be halted and American industry would soon lag in the race toward perfection.

The official view is discouraging to the whole idea of mass production. The War Department said in a statement to the Senate committee: "The popular notion that planes can be 'standardized' (frozen) and rolled off the production line like so many tin cans, is entirely fallacious."

With a strict interpretation of that statement there can be no argument, because obviously an airplane is not as simple as a tin can. But in its broader concept the attitude is open to sharp question as a result of the actual experience of Great Britain, Nazi Germany—and American industry itself. Many reasons exist to warrant the belief that an airplane is no more difficult to produce

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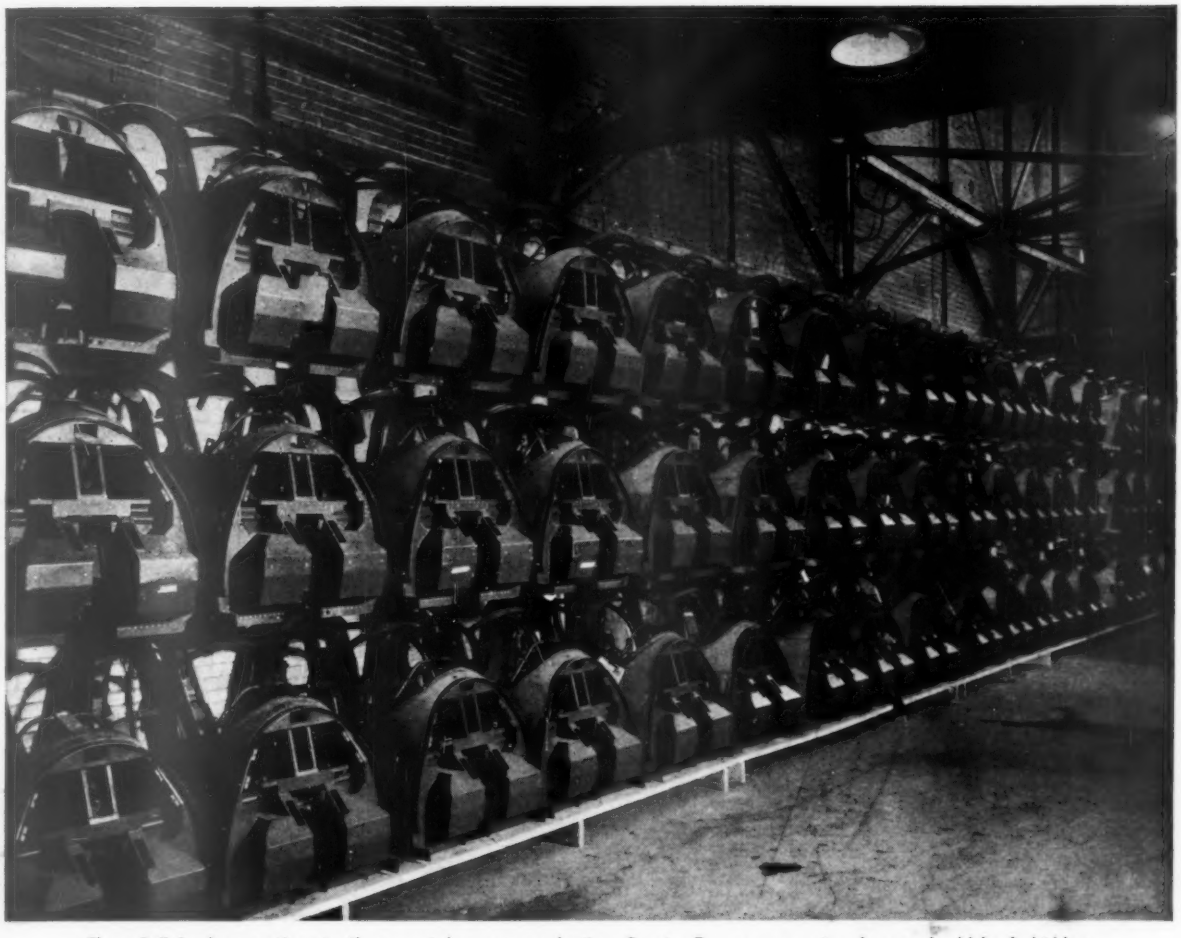


These Bell fuselage sections typify present-day mass production. Senator Truman says major changes should be forbidden.

Aircraft Designs!

Says

Senator HARRY S. TRUMAN

Recently returned from a nation-wide inspection of defense industry, the author believes U. S. aircraft production must be frozen in order to get tens of thousands of sorely-needed warplanes.

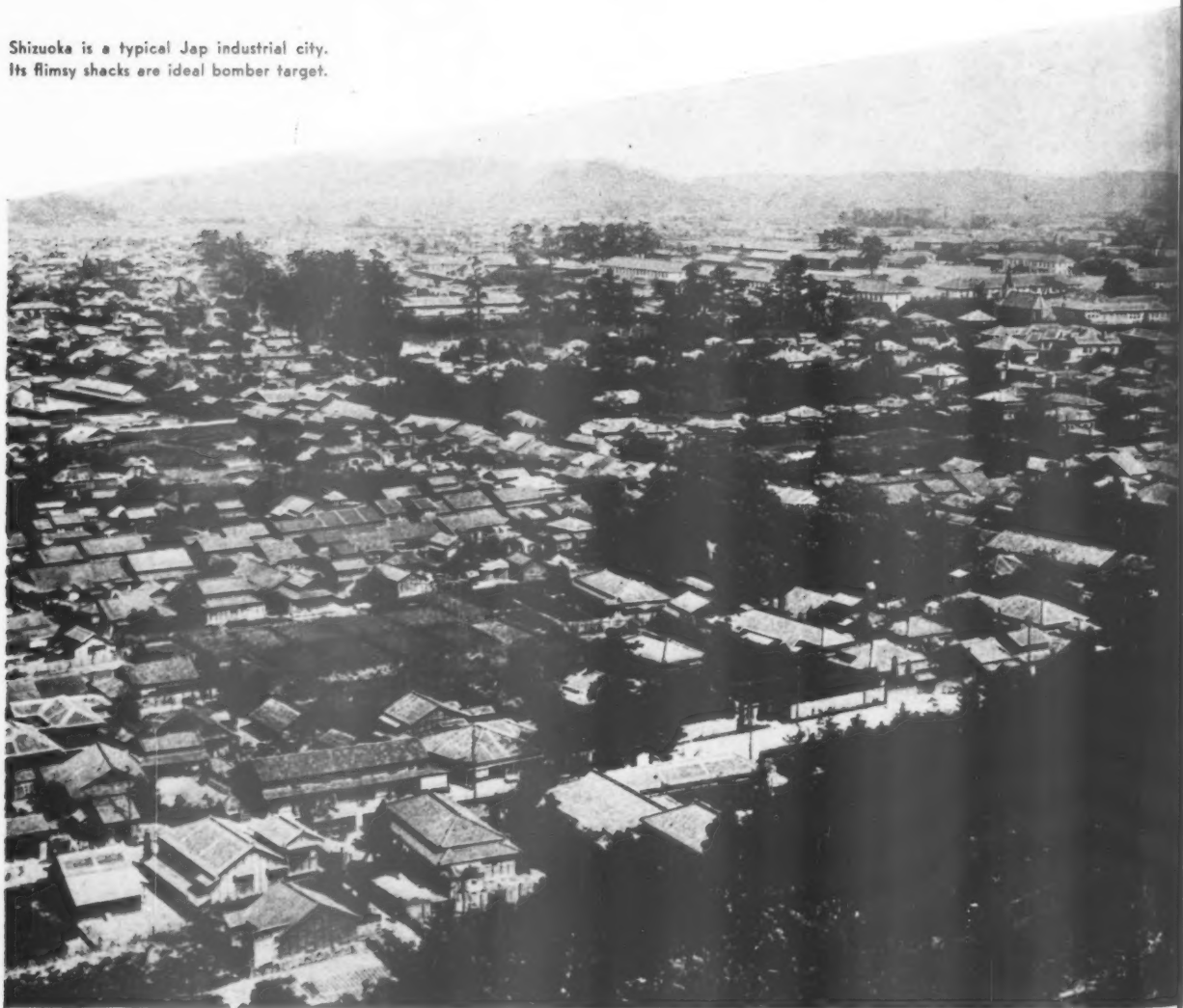
Harry S. Truman, one of the country's most active Democrats, has been a military man most of his adult life. Born in 1884, this native Missourian served in the Army's Field Artillery School at Fort Sill, Okla., during 1917-18, has been a colonel in the Reserve since 1927. He headed the Senatorial committee that recently investigated defense production.—Ed.

THE JAPS ARE VULNERABLE

by LEONARD ENGEL

There are many reasons why the Japanese cannot win in the long run. Many of them have to do with fundamental aeronautical weaknesses, detailed in this article. An Allied offensive should turn the tide.

Shizuoka is a typical Jap industrial city. Its flimsy shacks are ideal bomber target.



Long-range Consolidated B-24's can bomb Jap cities from Chinese or possibly Russian bases.

ON December 7, the "day of infamy," and in the weeks immediately following, the Japanese war machine scored a number of striking successes. In them the airplane, used with great shrewdness (to say the least) played a prominent part. This has led to the impression that Japanese aviation is powerful indeed, and that our previous dismissal of it as weak was wrong.

Yet our pre-war estimates were not so far off, although, as is now obvious, there was no justification (there never is) for having dismissed the Japanese force merely because it was not overwhelmingly powerful. The Japanese gains were due less to inherent Japanese strength in the air than to surprise, errors of judgment by their opponents (glaring example: sending the *Prince of Wales* and the *Repulse* beyond the umbrella of fighter protection), favoring geography and occupation of Allied planes elsewhere. For the Island Empire's aviation industry—and no air force is more powerful than the industry behind it—is small compared to the American, British, Russian or German. Its products are inferior as well.

Securing exact data on any phase of Japenese military activity or preparations has been practically impossible since the invasion of China in July, 1937. At that time an already harsh censorship was greatly tightened. Nevertheless, it has been possible to piece together a considerable body of information by which to measure the enemy's air industry.

This indicates that, despite intensive expansion efforts over a period of several years, Japanese plane and engine factories now are turning out not more than 4,500 aircraft a year, if that many. Early in 1940, even before the Tripartite Pact creating the formal military alliance among Germany, Italy and Japan was signed, Tokio began to import Nazi technical experts. (They reached the Island Empire via the Trans-Siberian railway; Germany and the USSR were not then at war.) Their efforts plus those of the Japanese themselves boosted production to a rate of 2,500 planes annually by January, 1941. The increase since then has been not more than 80 per cent and probably less. Thus 4,500 planes a year is the current top rate. For purposes of comparison, the last published rate (late last year, since exceeded) showed the U. S. was producing as many planes in a month as Japan in six.

There are several reasons why the Island Empire's air industry is thus limited and its progress slow. Most decisive is a shortage of aluminum. Japan produces practically no bauxite, the principal ore of aluminum, nor do the areas she has conquered on the mainland of Asia. She has had to import bauxite from overseas and pay for it in large part out of her limited supplies of gold and foreign exchange. Second is the peculiar organization of industry in Japan, with a great deal of production handled in extremely small shops almost completely devoid of modern power tools. Third is a perennial shortage of machine tools. Four years ago the Island Empire was only three-eighths self-sufficient in machine tools; its position has been improved since then, but Japan doesn't yet manufacture all the machinery she needs. Nazi aid has helped particularly in this direction but it hasn't been able to close the gap entirely. Fourth is the lack of an engineering tradition—the accumulated "know how" of modern industry. This is not only a general handicap, but is responsible for the well-known fact that virtually all Japanese planes of military or commercial importance are copied from foreign designs and are

Typical of the tinder-like buildings of all Japanese cities are these wooden houses of Tokio. One plane-load of incendiaries obviously would strike a devastating blow.

Boeing B-17E's would share long-range bombing missions against Japs with B-24's. Both now are in mass production.

hence inevitably obsolescent by the time they enter regular service. And fifth, the delays that always attend launching the manufacture of radically new engine and plane types (in comparison with what had been produced before in Japan). Within the last 18 months a great many of such new types have been introduced.

Most of the better known Japanese air manufacturers produce both engines and planes. There is, in fact, only one company which manufactures motors only, Nippon Diesel Industrial Co., Ltd. (Nippon Diesel's work is probably still largely experimental; at any rate there have never been any reports of Japanese aircraft diesels in regular use.) The seven plane and engine manufacturers are:

Aichi Watch & Electric Machinery Co.; Kawasaki Dockyard Co., Ltd.; Mitsubishi Heavy Industries, Ltd.; Nakajima Airplane Co., Ltd.; Showa Aircraft Co., Ltd.; Tatikawa Airplane Co., Ltd., and the Tokio Gas & Electric Engineering Co., Ltd.

Five other companies also are in the plane building field, but they don't make engines:

Kawanishi Aircraft Co., Ltd.; Nippon Airplane Co., Ltd.; Tokio Airplane Co., Ltd.; Tokio Aviation Co., Ltd., and the Watanabe Iron Works Co.

No planes designed or built by either Tokio Airplane or Watanabe have been reported recently, however, and it is doubtful that either is now independently active.

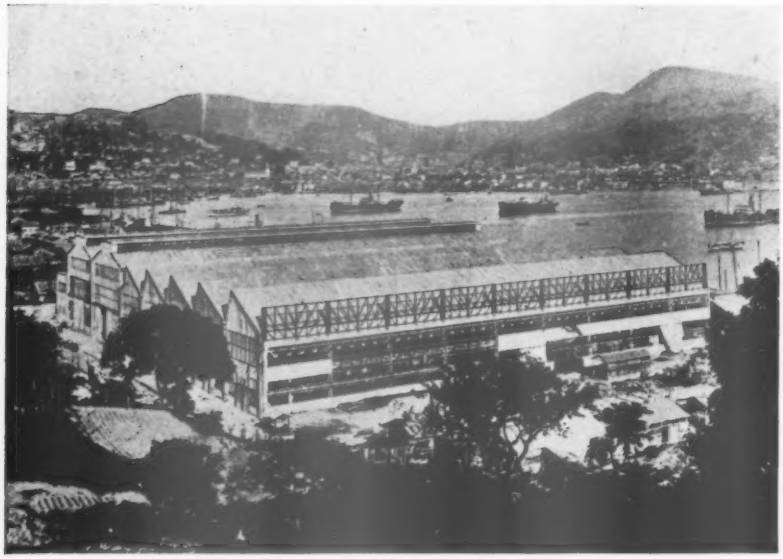
Practically all Japanese aircraft of military importance originate in the shops of four of these companies, Kawanishi, Kawasaki, Mitsubishi and Nakajima. A fifth, Tatikawa, is of considerable importance as a supplier of trainers. Kawasaki and Mitsubishi, curiously enough, are not primarily aviation organizations at all. The Kawasaki plane plants are simply departments of Japan's second biggest shipbuilding company. Mitsubishi is the largest heavy industrial organization in the Empire and includes not only plane plants and the biggest private shipyards in Japan, but also great machine and tool building departments. Kawasaki is tied in with the Sumitomo family combine, one of the three fabulously wealthy family trusts which dominate Japanese industry. Mitsubishi is another of the three trusts. Kawasaki and Mitsubishi both specialize in army fighters and bombers; Kawanishi, whose plant is on the Inland Sea near the great port of Kobe, is the chief producer of seaplanes and flying boats; and Nakajima turns out wheeled craft of every description for both the army and navy. Nakajima, founded just before the last war, is the oldest Nipponese aircraft manufacturer.

How many now are employed in Japanese plane and engine plants is a particularly closely guarded secret. However, it is known that Mitsubishi, the largest aircraft organization, had 6,000 employees at its Nagoya (one of the chief Japanese munitions centers, on the Pacific coast of the main island) factory in 1938, and another 2,000 on aircraft work at its Tokio plant. Since then Mitsubishi has at least doubled in size. Nakajima is almost as large, but none of the others has half as many employees as Mitsubishi. A fair guess for present employment in the industry is 75,000 to 125,000.

In Germany, Britain and the U. S. A., an independent design and engineering tradition, regardless of how much borrowing, exchanging and copying of ideas goes on among them at all times, war or no war, is the base of each aeronautical industry. In the Island Empire the situation is reversed. Although the Japanese have made some original contributions, chiefly in the nature of adaptations of the work of others, the bulk of the engineering is based on foreign work, whether in the form of pirated designs (not so common in aviation as in other fields owing to the greater difficulty involved), commercial licenses or licenses

(*Continued on page 82*)

Illustrative of the vulnerability of vital Japanese ports and facilities is this photograph of Nagasaki harbor. Building in foreground is one of Mitsubishi plants.



The Private Pilot and the War

War automatically grounded private flyers, now limits them to flight plan operations.

by CHARLES I. STANTON

Acting Administrator, Civil Aeronautics Administration

Civil flying by registered flyers still will be permitted. The author, CAA chief, herein outlines restrictive control that must be enforced for the war's duration.

Charles I. Stanton.

WHAT can the private flyer do with his airplane?

What is he not allowed to do?

On the answers to these two questions depends the immediate future of private flying, and, fortunately, the answers are favorable to such flying.

In general, the private flyer can do anything worthwhile and useful that he ever did with his airplane, provided, first, that he is an American citizen or citizen of a friendly nation and of unquestioned loyalty, and, second, that he meticulously observe the additional traffic control regulations which the war has made necessary. These requirements need not stymie private flying. In fact, viewed from the vantage point of long experience with flying, it may actually result in an improvement of private pilots and private flying technique. Of course, such restrictions as may come about through shortage of rubber, gas, oil or spare parts are an altogether different story.

In the CAA we have felt proud of the way the private flyers of this country have accepted the emergency disruption of their flying habits. When we suddenly grounded all pilots immediately after Pearl Harbor, there were numerous inquiries and requests for fast action in restoring flying status to pilots who were flying for their daily bread. There were a very few private flyers who complained of being inconvenienced, taking into consideration the difference between complaining and grousing. That shows an appreciative attitude toward the problems that faced us and the bigger problems facing the nation.

This convinces us that private flyers will accept restrictions, and it corroborates our repeated statements that civilian flyers probably have a higher percentage of patriotism and loyalty than any other group of people in the country. On our side, we are determined that these inconveniences will be as minor as possible, so that after the war commercial and private flying will become as valuable an instrument for national recovery as we confidently expect it to be.

The President's order of December 13, 1941, reads, in part, "In the administration of the statutes relating to civil aviation the Secretary of Commerce is directed to exercise his control and jurisdiction

Courier service is an important duty of CAP members. Here, pilot of Stinson "105" is given package for delivery. He will be compensated for time and plane.

over civil aviation in accordance with requirements for the successful prosecution of the war, as may be requested by the Secretary of War." Following a subsequent request from the Secretary of War, the Civil Aeronautics Board adopted amendments to the Civil Air Regulations, which provided for the control of civil aviation considered necessary to prevent civil flying from becoming an implement of sabotage or subversive activity. Thus was laid the foundation for the CAA to work out the detailed measures necessary to accomplish the objectives of the general provisions of the CAR. A summary of the detailed requirements may be of assistance to the average private flier.

The three fundamental requirements today are that any pilot permitted to fly must have been investigated and approved as to citizenship and loyalty and carry an official identification card bearing photograph, fingerprints and signature; that every flight, with certain specified exceptions, must be a controlled flight, carried out in accordance with a flight plan examined and approved by a designated clearance officer and properly recorded in an airport register by a designated registrar; and that airplanes while in flying condition, and not in the custody of reinstated pilots, must be under guard adequate to prevent theft and use in any unapproved manner.

The requirements for identification and investigation of pilots for reinstatement of pilot certificates is now a matter of recent history. It is well on the way to completion and needs no further explanation at this time. Guarding of aircraft and control of flights have as yet not been fully applied and are naturally a matter of concern to civil flyers.

Civil aircraft may not be operated except from designated landing areas or airports. In order to receive a designation an airport must, in the first instance, be provided with adequate guards throughout the 24 hours of each day. No uniform guard requirements can be established because of the wide variance in the volume, type and hours of operation at various airports. All guards, however, must be clothed with authority to make arrests or, at least, to detain suspected persons until they may be turned over to the custody of regular law enforcement officers. Also, guards must be provided with suitable means to summon help other than by voice. Where the conditions of operations permit, guards may perform other duties simultaneously with carrying out their guard duties. During the night hours, where aircraft are all housed in a securely locked hangar, the assignment of a person to sleep in the hangar near the point where entrance would have to be forced may be found adequate for guarding during such hours. The CAA inspectors will consider each case on its own merits and request only the minimum consistent with security.

Adjacent to each designated landing area there will be designated one or more local flying areas, which will be bounded by prominent and easily identifiable land marks, within the boundaries of which there are no military, manufacturing, or other establishments over which flying should not be conducted. All local flights —practice or pleasure—must be carried out within these areas. Flights from one designated landing area to another, which will be considered cross-country flights, will be carried out on predetermined routes and schedules. In some sections of the country such flights, except they be ferry flights connected with delivery of aircraft to new owners or necessitated by change of the aircraft's base of operations, may only be made by aircraft equipped with two-way radio. In all sections two-way radio will be required for night flights. To provide for proper control, each designated landing area must have a registrar and clearance officer on duty throughout the hours of flying operations; and it must maintain an accurate and adequate airport register in which all flying is duly and promptly recorded.

The registrar and clearance officer is a new type of official around civil airports. He has many duties, and a description of these duties gives the private pilot a fairly adequate picture of what he can and cannot do in his flying today.

The registrar and clearance officer is required:

To maintain an accurate and adequate landing area register containing all the information required with respect to every aircraft arriving at or departing from the landing area, on the form prescribed by the Administrator of Civil Aeronautics, and to keep proper files of aircraft arrival notices and aircraft clearances, properly cross-referenced to the airport register; and to permit the inspection of same by any proper official having interest therein.

To clear each aircraft departing from the landing area. No aircraft shall be authorized to take-off without the issuance to the pilot of an official written clearance previous to such take-off except as otherwise specifically provided in these instructions.

To require that complete information be entered on each clearance form before issuing clearance.

To see that the pilot and departing aircraft are properly certificated, carry the required identification and have complied with all Civil Air Regulations with regard to the carrying of aliens, other

(*Continued on page* 88)

The New Strategy of War

by CY CALDWELL

The basic conception of armies and navies as a nation's chief defenders must give way to a new standard recognizing the importance of air power.

IT HAS for many years been our national military and Naval policy to consider aviation as a part of the Army and Navy, as air support for our land and sea forces. The basic idea is that the Army or Navy, or both working together, use what air power we possess in an auxiliary capacity. Inevitably this conception relegates air power to a subsidiary role. It explains, in part, the numerical insufficiency of our initial air efforts in the Pacific; of our having too little anywhere.

However, even if we had possessed a distinct and politically independent air force—robbing the Army and the Navy of all the aviation they possess—that would be no guarantee that we would have had more planes or more pilots than we have under our present system. The fault, it seems, lies not so much in the organization of our air forces as it does in our national conception that wars are fought by armies and navies, and that air forces merely help them. Nowhere in our thinking, as expressed by our military and Naval commanders and by the majority of military analysts, do we find the suggestion that naval and land forces should act in supporting roles to air power. But recent war experience indicates that this may be the new strategy of war, as yet only dimly perceived.

Apparently the Japanese, long advertised as mere imitators of Western ideas, have been the first to perceive this. Their initial contribution to the science of warfare has been the painful demonstration that air power is the weapon par excellence of surprise, of devastating attack successfully carried out before the opponent can rally and put up any effective opposition. It is needless to discuss Jap treachery or the complacency of American commanders in Hawaii, both of which contributed to disaster for our forces there. No discussion of ethics or lack of ethics, as such, has ever had any appreciable effect upon the outcome of war, which is decided chiefly by blows given and received, by physical forces. It is equally needless at this time to discuss a separate air force; for the question of a separate air force does not enter into the consideration of American-British-Japanese moves in this opening phase of the war in the Pacific.

Neither the United States nor Japan have independent air forces; they are part of the Army and Navy. Great Britain has its distinct Royal Air Force; but it also has its Fleet Air Arm, as we have. Thus, in military organization, the Japanese and their opponents have approached the problem of air power in the same way. That they have achieved different results seems to be due to a more ready acceptance by the Japanese of the vital importance of air power, whether ship-based or shore-based. In Pearl Harbor, for example, they used air power not as the spearhead of the attack, following the German conception, but as the sole attack. It was the boldness of this conception, added to their long-known disregard for ethical considerations, that gave them victory in that theater. Let us add, thankfully, that they can't repeat the trick; we're awake now—we hope. But the reason we were caught napping deserves profound study. For the reason lies deep in the standard thinking of a majority of our senior American Army and Navy officers, and of British senior officers as well. Unless that thinking, that basic conception of armies and navies as our chief defenders, is changed, we are in for more bitter lessons as the war goes on.

In the Philippines, as in Hawaii, the Japanese practically wiped out American interference in the air; that was apparent from the opening moves when we soon heard nothing of American fighter planes, but only of American anti-aircraft batteries bringing down Jap bombers. The initial air situation in the Philippines has not been explained by the Administration; but explanations are needless. The war reports indicate that the small air forces we had there were wiped out soon after the start of hostilities. Why? Simply because we didn't have enough. There can be no other reason. But the Japs had enough; and they had enough because they had visualized, before the war started, the vital need for air supremacy without which they could not effectively invade the islands by sea. It was an old lesson that American students of air power had been telling for years; but only the Japs listened, apparently.

British experiences in Malaya again underline the importance of air power, used in support of an invading army or used independently against a navy. And here again the Japs had the initiative to hurl carrier- or land-based airplanes alone against battleships—while the British followed the old style of thinking that battleships and destroyers, unescorted by supporting aviation, could survive against a possible, in fact a probable, air attack.

The British navy is primarily a surface force; its air component is considered to be an auxiliary. The backbone of the fleet is the battleship, not the airplane carrier. Our Navy feels the same way, apparently; and so, evidently, does the Japanese navy, judging by the proportion of carriers to battleships. There have been long and weighty technical arguments as to the relative fighting efficiency of battleships and airplane carriers, but as all of the warring nations in the Pacific possess both and will use both, arguments about their relative efficiency become largely academic. It's my present guess that carriers and their attendant warships will sink battleships; and that battleships and their flotillas will sink carriers—the Germans have sunk the English carrier *Glorious* with the *Scharnhorst* and *Gneisenau*, and one German submarine has sunk the carrier *Ark Royal*, while the German battleship *Bismarck* was brought to bay chiefly by English torpedoes dropped by carrier-based aircraft. In short, anything that floats also will sink. Just as anything that flies may be brought down.

But we're not concerned here primarily with weapons and their utility, but with the way our naval and military leaders think of them. The Japs were successful at Pearl Harbor with three or four carriers that our land-based bombers should have been able to sink, unless they had been put out of action first, as they obviously were. The British were completely unsuccessful with two battleships off Malaya, not because battleships are useless, but because the British admiral didn't know they were so vulnerable without supporting aircraft of their own. The

(*Continued on page* 58)

This inconspicuous little shop houses a busy Republic subcontractor.

The sailmaker makes canvas accessories for Army aircraft.

THEY DELIVER THE GOODS

by LEO PATRICK MURRAY

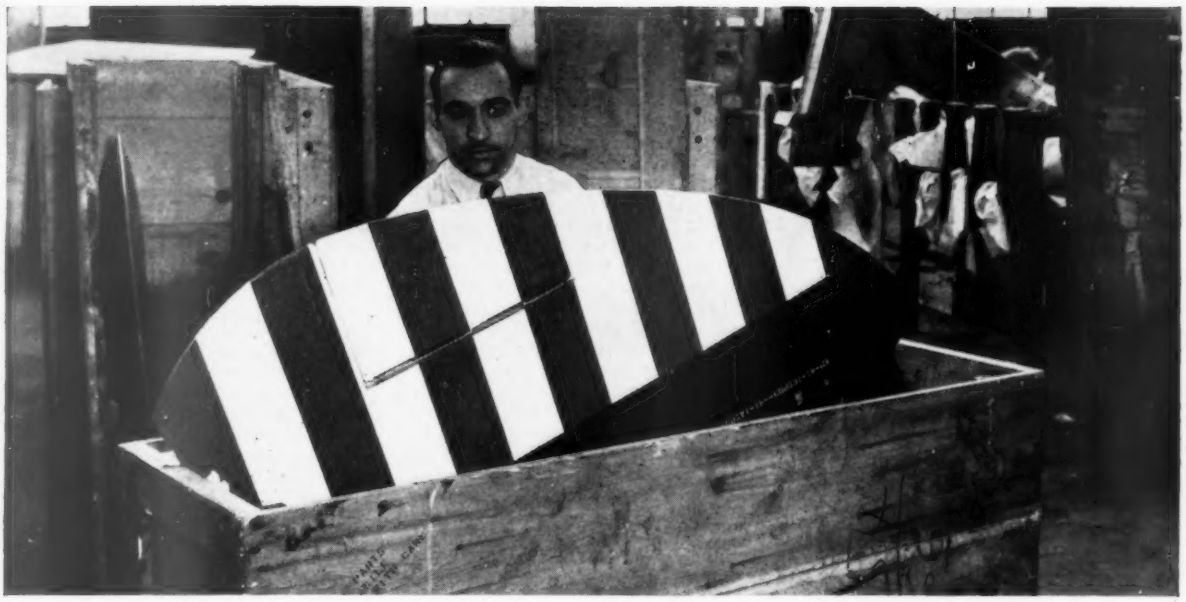
Subcontractors are the veins that feed the arteries of the aircraft industry. Almost any workshop can get into the ever-widening parade.

PARTNERSHIPS for production—that is the working relationship which the nation's aircraft industry and thousands of large and small machine shops, button-stamping outfits, novelty manufacturers, refrigerator makers, motor builders, jewelry establishments, light-plane companies, sheet-metal businesses, repair shops and a multitude of equally unrelated enterprises are combining their efforts to push the output of military airplanes for an allied victory.

The industry calls it subcontracting. Washington calls it the salvation of the small peacetime business which is floundering on the rocks of priorities. The economist sees in it a development similar to that which has made the mass production of automobiles possible—the creation, by the industry, of a vast second line of suppliers and specialty manufacturers who will provide the assembly lines of tomorrow as well as today with the needed "bits and pieces" which will be required.

Every major airplane company has gone into subcontracting for about all that it is worth. A typical example of the subcontracting plan, developed to a logical ultimate, is found at Republic Aviation Corporation, Farmingdale, N. Y., where the Air Forces' mighty *Thunderbolt* (P-47) interceptors now are rolling out because hundreds of outside concerns, as well as the parent company, are doing their level best to keep them rolling.

Through necessity, Republic has always leaned heavily on subcontracting in its production scheme of things and the demands of the present emergency have meant only that the company has



From another subcontracting factory Republic gets finished assemblies. This rudder is for an Army P-43.

thrown into high gear a production department already in operation.

Until a year or so ago, Republic was one of the smaller units of the industry, yet periodically it received somewhat larger orders for its pursuit planes than the small company could conveniently handle—especially since such sizeable orders, from the United States or foreign purchasers, generally followed periods of famine in which orders and production work were practically non-existent.

One answer to this difficulty was to have a very flexible producing organization—and a flexible organization meant one in which farming-out of work played an important part.

As early as 1936, the organization which is now Republic was relying on other manufacturing units for a vital portion of its production work. Through the next two or three years, these companies were educated and integrated into the Republic production plan and Republic's own production men early learned how to handle the knotty problem of releasing work to others.

Therefore, in 1940, when Republic suddenly faced a five-fold expansion in production capacity, a 10-fold expansion in personnel and a series of contracts which reached toward the $100,000,000 mark in value, the part which subcontracting was to play was already well understood and anticipated.

Today, Republic is subcontracting—giving to other units work which it might logically be expected to handle itself—about 25 per cent of its production work. Some 100 firms are sharing in this volume of work which may reach at least $20,000,000 when present commitments are signed and sealed.

These orders call for parts, subassemblies and special work for both the P-43 *(Lancer)* and the P-47, high-altitude pursuits which Republic is turning out for the Air Forces. However, the P-47 (first 2,000 h.p. Pratt & Whitney single-engined pursuit plane to be delivered to the Air Forces) is, significantly enough, the most widely subcontracted plane to be produced at Republic, and Republic executives are frank to admit that the rate at which these super-fighters are delivered to the Army will depend largely on the performance of the various key subcontractors. From experience with these firms, no serious difficulties are anticipated.

Among the parts of both planes (or one of them) which are being manufactured wholly or in part outside of the Republic plants at Farmingdale, are:

Flaps, engine mounts, complete landing gear assemblies, rudders, ailerons, wing tips, exhaust collector rings, bomb and armament mechanisms, fire walls, pilot seats, elevators, instrument panels, cockpit canopies, fins, a large volume of miscellaneous machined parts, gun boots and all other fabric parts, electrical units and many other items, including certain special tools and fixtures which are not installed in the finished plane but which play a fundamental role in Republic's own production work.

All types of concerns have shared in this distribution of Republic's work—companies in at least 16 states from the

Engine mounts are welded up complete at a Pennsylvania factory, then shipped to the Republic assembly plant. Identity and location of subcontractors now are restricted.

Once famed for precision work on marine engines, this shop now makes plane parts.

east to the west coast. Many of them are very small machine shops or sheet metal companies in the Long Island area and New York City which are easily integrated from a supervisory and delivery standpoint because of their convenient location. Others are in California, Oregon and the far south. New England organizations have a large share.

On some companies, Republic has leaned so heavily that it has never developed the "know how" or facilities which these other concerns already possess to a satisfying degree.

One company years ago proved it could handle Republic's work on a specific type of structure, involving a specialized material. In effect, that concern became a regular department of the Republic factory—for that special type of work. It was given Republic's work in its line just as Republic's own wing department was given Republic's wings to build.

Later, a second concern was found which could do a fine job in the same specialized field and it was given substantial orders. From the two outfits, Republic feels satisfied to obtain that certain specialty without going into the proposition in its own factory.

The above example emphasizes another cardinal principle in present-day subcontracting—the establishment of two sources of supply. Major companies like to have two spots to which they can turn for vital materials, as insurance against labor difficulties, price "holdups," loss of a supplier through his selling his full production capacity elsewhere or any other unforeseen circumstances which may beset the contractor-subcontractor relationship.

Most subcontracted parts are built through the use of the same sort of special tools, jigs and fixtures which go into all aircraft production. This has given rise to another important proviso in the relationship of a prime contractor with his suppliers.

The prime contractor pays the subcontractor a sum sufficient to meet the cost of the tools or jigs which go into his work and ownership of these tools rests with the prime contractor. Thus, if the major manufacturer wants to place a later order for similar parts elsewhere, or if he decides that the subcontractor is falling down and that the work will have to be done in the home plant, these tools can be claimed, moved out, and put into production anywhere that the prime contractor chooses. Manufacturers have learned in the past that ownership of valuable tools by subcontractors gives the subcontractor a virtual stranglehold on the customer.

This latter circumstance illustrates a common type of error which too many of our aircraft companies have committed in the early stages of their entrance into wide-scale subcontracting. The production department of X Airplane Company studies the drawings for its new model and comes to the conclusion very promptly that Engineering really has designed something in that new main wing spar—or that new type of engine cowling. Production squawks that nobody in his right mind could design such a thing and that no company in its right mind could possibly build such a contraption in less than 1,000,000 man hours. Engineering remains adamant and, as usual, wins out, so that Production is stuck with the job of building this very, very difficult article.

Landing gear parts come from this shop. Republic subcontractors total nearly 100.

Too often, this is the type of assembly which X Airplane Company, at the behest of its production department, subcontracts to some enthusiastic outsider who is overly-anxious to break into the X subcontracting picture. X shortsightedly keeps for itself the easy, profitable jobs, and Mr. Subcontractor is stuck with the tough ones.

The result? Mr. Subcontractor falls down on deliveries or loses a lot of money, his relationship with X is permanently soured, X gets behind in deliveries because the subcontractor is late, the X production department has to take the job back and build it anyway and X has lost a good subcontractor—who, if treated easily and given an education in the beginning, might have been of great help to X and to the defense program at large.

Companies have gone through this stage and have learned their lessons, and it is safe to say that new and green subcontractors no longer are permitted to let their enthusiasms or self-confidence get the better of them because of the wishful thinking of the prime contractors.

Speaking of other specialists whom Republic employs, one company has worked to a predominant position in the supplying of engine mounts, flaps and pilot's and bomber's seats to companies from one coast to the other. Another has similarly entrenched itself in the seat and other fields. These specialist companies, major manufacturers will concede, can do a better job on their No. 1 items than can the parent companies and, since standardization of seats, mounts and similar items now is becoming the rule, they can frequently do the job cheaper because they are in real mass production on their specialties.

There are numerous human-interest stories in the Republic subcontracting picture. A tiny sail-making shop, with a half-dozen employees, located in a little fishing village has booked $15,000 in orders for control stick sleeves, engine covers, fume boots and other canvas and neoprene parts.

(*Continued on page 92*)

One-fourth of all parts going into Republic's famed P-47 now come from subcontractors. Once ready for mass production, other plane plants also may produce complete P-47's.

FOR IDENTIFICATION

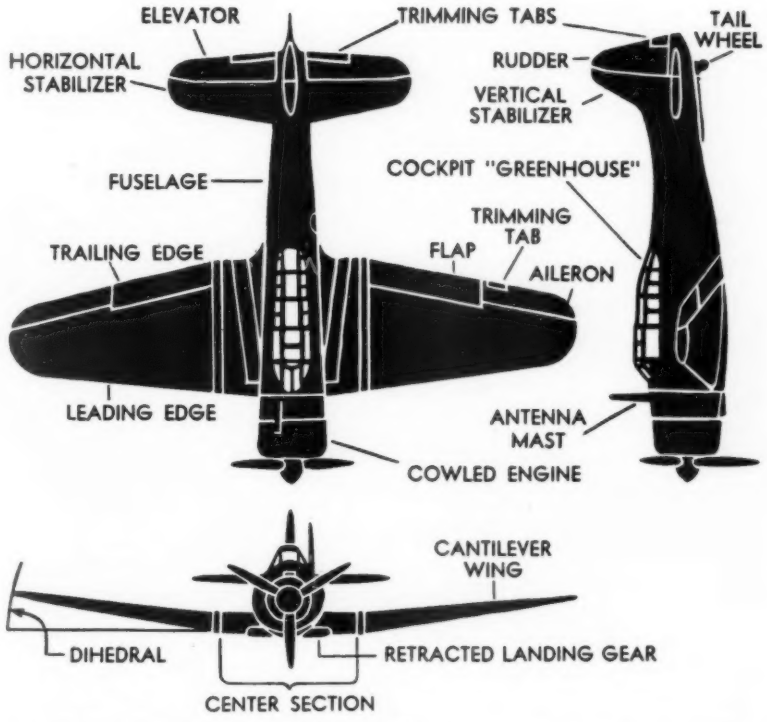
Germany.

Japan.

Italy.

THIS is the second in FLYING'S new series of silhouettes, to be continued as a monthly feature for the duration of the war. The silhouette of a U. S. Navy Douglas SBD dive bomber on this page is used to illustrate the salient parts of a typical airplane. Uninitiated civilians, whose job it will be to spot aircraft, should study all these points carefully; all instructions they receive or terms they hear will incorporate these standard terms. On the following two pages are two Japanese, one German and one Italian type; the latter two are reproduced through courtesy of The Aeroplane, England.

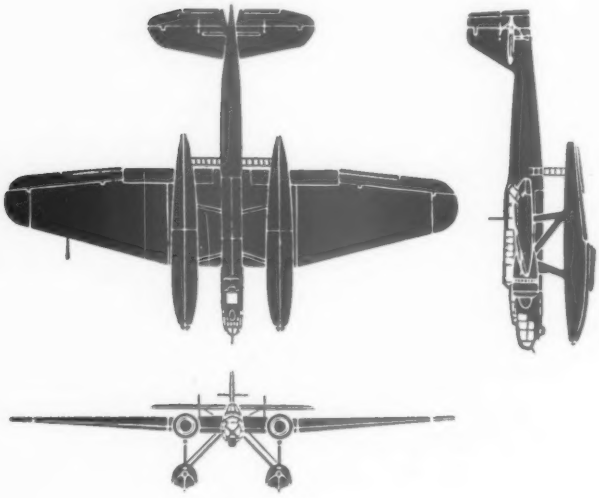
The Fundamental Parts of an Airplane



With a few variations, depending upon the aircraft involved, the parts indicated and named above are standard. Variations from this particular type of aircraft would be used if one were speaking of a flying boat, a seaplane, biplane and so on. But basically they all have rudders, ailerons, stabilizers, etc. Differences between this SBD and other aircraft might include fixed landing gear, an externally braced instead of cantilever wing, open cockpit or twin rudders. Or the wing might not have dihedral (the degree of upward tilt of the wing). So aircraft spotters should practice identifying basic parts of aircraft by studying the designs shown in this department.

HEINKEL He-115

Reconnaissance-Torpedo seaplane



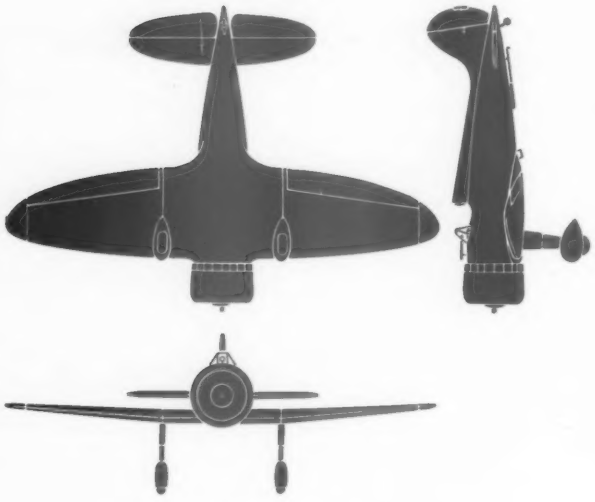
Courtesy "The Aeroplane"

PERTINENT FACTS: One of the oldest types still in use by the Luftwaffe, the Heinkel He-115 is used primarily for reconnaissance, as a torpedo plane and for mine-laying. Because it is comparatively slow and lacks maneuverability, in addition to being poorly armed, the He-115 is not generally seen by Allied aircraft; RAF pilots have called this type "only fair target practice." Several modernized versions of the He-115 have appeared. Span is 72 ft. 10 in.; length, 56 ft. 9 in.; and height, 21 ft. 7 in. The version powered with 850 h.p. BMW air-cooled engines carries a payload of 7,260 pounds; the plane's gross weight is 20,790 pounds. Normal range is 1,305 miles, cruising speed is 186 m.p.h.

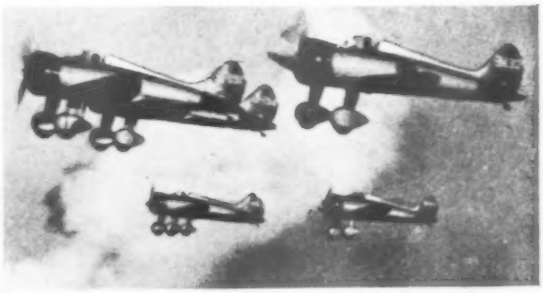
WHAT TO LOOK FOR: The big twin pontoons probably would be the first clearly recognizable feature at a distance; they are standard on this type and are not interchangeable with wheels as is the case with most seaplanes. The fuselage is long and tapering. The large wing (941.8 sq. ft.) has pronounced leading edge taper; slight trailing edge taper is evident, but only outwards from the flaps. The cantilever wing has a slight dihedral. The tail assembly features an angular vertical stabilizer and rudder, although the horizontal stabilizer and elevator have taper and rounded tips. FIXED step-ladders from both pontoons to the rear cockpit are notable.

NAKAJIMA 97 (NAVY)

Single-seat fighter



Drawing by Paul W. Lindberg

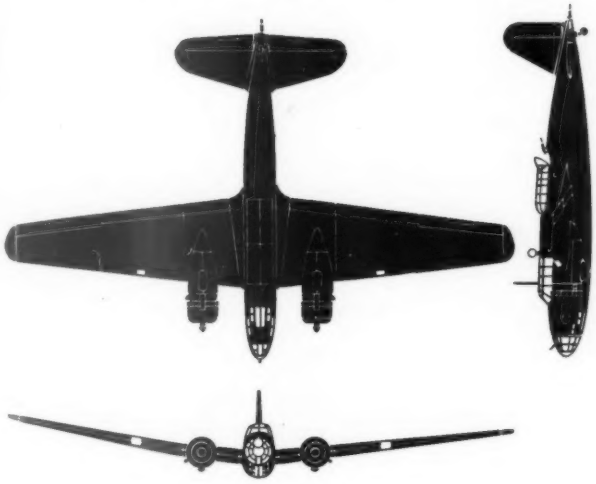


PERTINENT FACTS: Little specific information is available on this aircraft. Specifications are limited at the moment to the facts that its wing span is 35 ft. 5 in., length is 25 ft. 7 in. and height, 7 ft. The Japanese navy's standard carrier-based fighter, the Nakajima 97 looks strikingly like the old U. S. Army Boeing P-26 pursuit. Its air-cooled radial engine is relatively low-powered; armament is understood to be comparatively light. British and American pilots who have shot down numbers of this type say it has maneuverability but little else.

WHAT TO LOOK FOR: The gangling, fixed landing gear is one of the most obvious points. Judging from the photographs available, this gear has a good deal of "play" in its shock absorption equipment, hence the wheels hang fairly low when the aircraft is in flight. The cantilever wing has slight taper from the center section out; the elliptical outline of the wing resembles somewhat the shape of the Spitfire wing. The ailerons extend almost the entire length of the wing panels themselves, ending a few inches from the center section. Also, this is one of the few fighters in operation today that has an open cockpit. Notable, too, is the fairing extending from the pilot's head rest back directly into the vertical stabilizer.

MITSUBISHI 97 (ARMY)

Medium-range landplane bomber



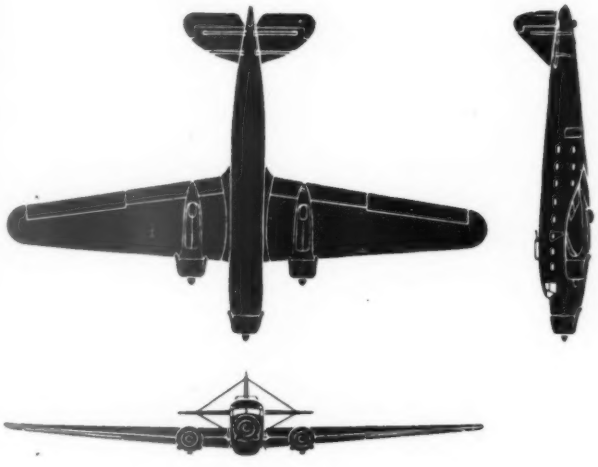
Drawing by Paul W. Lindberg

PERTINENT FACTS: Probably the most modern bomber of its type in the Japanese army or navy air forces, the Mitsubishi 97 is a mid-wing twin-engined monoplane that is popularly believed to be a composite copy of several American and British types. Aircraft of this type were reported by British sources to have taken part in the destruction of the "Prince of Wales" and "Repulse" off Malaya. First produced in 1937 (hence the 97), this ship has a wing span of 85 ft., is 61 ft. long and 15 ft. 6 in. high. The engines are 1,000 h.p. Mitsubishi air-cooled radials, based on a Wright "Cyclone" model. Its payload is reported to be an even ton of bombs, which it can carry for a maximum range of 1,000 miles. Armanent consists of three machine guns, hence its best defense against attack by enemy aircraft is its speed (about 230 m.p.h.).

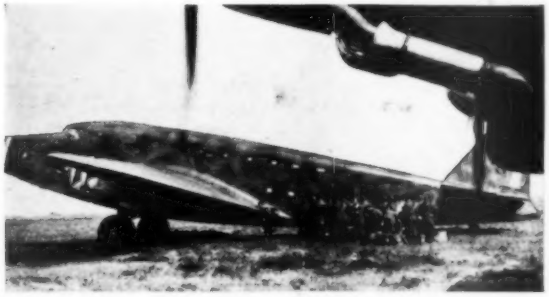
WHAT TO LOOK FOR: With the general overall appearance of an American Martin design, the Mitsubishi 97 has at least one unusual point that should attract the attention of spotters: the rear cockpit. Placed quite high on the fuselage in relation to the pilots' cockpit, the rear "greenhouse" extends just back of the wing's trailing edge. The wing itself is of conventional design, with leading and trailing edge taper and rounded tips. There is a marked degree of dihedral, both in the wing and center section. The landing gear is retractable, though about one-fourth of each wheel protrudes beneath the engine nacelle.

SAVOIA MARCHETTI SM-82

Long-range landplane bomber



Courtesy "The Aeroplane"



PERTINENT FACTS: Probably the longest-range bomber in the Italian air force, the SM-82 first made its appearance about two years ago. Powered with three air-cooled Alfa Romeo engines, each developing 950 h.p., the SM-82 is being used both as a long-range bomber and as a troop carrier. Wing span is 97 ft. 6 in., length, 73 ft. 6 in., and height 18 ft. Popularly known by the Italians as the "Canguru", the SM-82 has a range of 2,400 miles; gross weight is 19 tons. Top speed is 230 m.p.h.

WHAT TO LOOK FOR: General outlines of the SM-82 are typically Savoia Marchetti design. This manufacturer is one of the few remaining builders to produce tri-motored aircraft; the SM-82 looks a good deal like the smaller Savoia Marchetti bombers at first glance. Notable points to look for are the thick cantilever wing and the deep, "two-story" fuselage. Of course, the presence of three engines shoud be one of the first identification points. The wing has slight dihedral and both trailing and leading edge taper, but more of the former. The tail assembly is of standard single-unit design, marked especially by the externally-braced stabilizers. The landing gear is partially retracted, with the wheel protruding slightly from the engine nacelles.

WAR UMPIRE

by Lieut. Col.
ROLAND
BIRNN

Douglas A-20A's swoop low in strafing defending "blue" army's supply convoy.

An umpire during peacetime maneuvers, the author was one of those whose strict enforcement of the rules guides Army pilots now engaged in real war.

WHEN ponies run, it's the judges; in football, the referee; in contract compromises, the arbiter; but in air maneuvers, Blues versus Reds, it's the umpire who decides the victories, losses, penalties and delays. In baseball the umpire wears no uniform but dons a peaked cap and an air of authority. In air maneuvers the umpire is just one of the group's or squadron's officers, attired in the same uniform but wearing an armband of white where the players wear their respective colors of red or blue. Where practicable, the umpire planes are unmarked in contrast to the red cross appearing on the Red planes and the visible white cross on the planes of the Blues.

Although the large scale air maneuvers were a peacetime activity, they represented the last of our military movements preparing our boys for war. Umpiring made these maneuvers more realistic than ever before, especially to the commanders of all outfits, down to squadron and flight commanders. If the boys now flying and fighting in the Far East are doing a good professional job, it is largely because of lessons many of them learned in air maneuvers, and the grief descended upon them by umpires' decisions in maneuvers taught them lessons which are lessening grief to their outfits, and themselves, now that the war game is *real*, and not merely simulated.

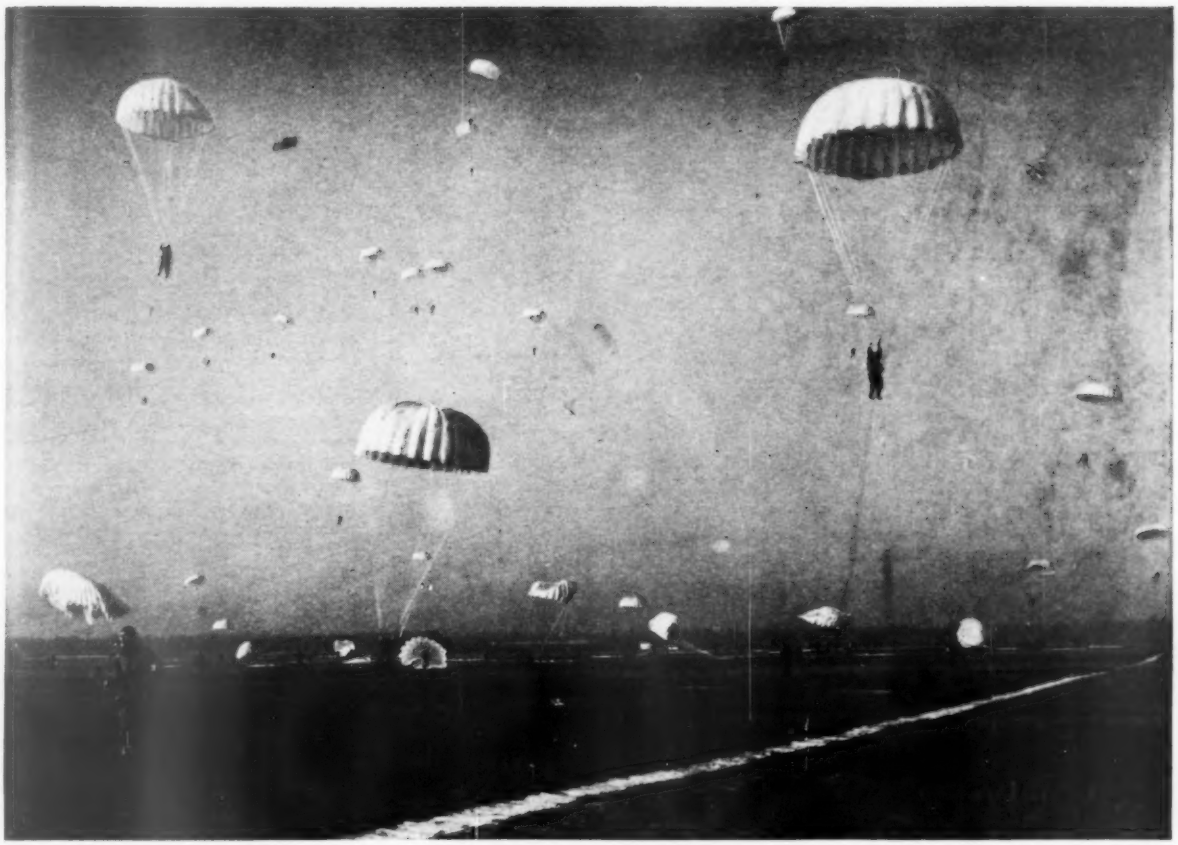
Spectators of our ground and air maneuvers in Louisiana and the Carolinas, may have noticed "jeeps" dashing about wherever action was thickest, white flag snapping from above the hood. These reconnaissance cars held ground umpires on their way to decide action of rival ground units or perhaps the damage caused by a lapful of bombs about to be dumped on an important bridge, the bridge *actual* but the bombs *simulated*.

In the ground forces the umpire had no sinecure; he was generally a very junior officer, one to a company, and he went wherever the troops did, through creeks, over rainswept hills and without sleep. When he saw the outfit he represented come to a grip with the enemy, he halted all action, regained his breath and then made the decision. If the situation was an involved or unusual one, he had time to refer to the umpire manual or consult his senior umpire.

In the pursuit or bombardment units the umpire had it equally hard; maybe a little more so, as he flew along with his unit, climbed with it, fought with it, bombed with it. Then he judged it immediately without time for a breathing spell. In the attack or engagement he was just as much a part of his outfit as the next man; but always in the back of his mind was the question—"How will I umpire *this* one?" As it was impracticable to have an umpire's accompanying plane fly in a detached position from the formation which he umpired, he took active part in the whole action. Occasionally the bombardment umpire rode along in the rear or co-pilot's seat, but the poor pursuiter was an honest-to-goodness working stiff. Rear seats? Zero.

("Anyway, I'm not losing any flying time; it's only my leisure time this umpire job is cutting to nothing," remarked the umpire of the 55th Pursuit Squadron to the author, during the Carolina maneuvers last November).

Nor did the bombardment or pursuit pilot have much time to figure the thing out. As soon as an air combat was over, he notified the formation leader of his own side just how many casualties they



Paratroops proved their efficiency during war games. Here they descend on Pope Field, N. C. Once on ground they leave 'chutes, race to overcome foes.

had received according to the provisions of the umpire manual. The leader radioed the "dead men" to drop back a half mile from the formation or to return to their home airport at the "casualty altitude," (1,000 feet) rocking their wings if attacked by hostile pursuit, to show they were out of the fight and not fair game. Sometimes the action was so rapid that the casualties had not yet been pushed out of the formation before the outfit was again attacked by the enemy.

Air umpire procedure was based on the following:

1. One umpire appointed for each squadron, and one for each group, the latter generally acting as airport umpire, to assess losses should the airport be attacked by the enemy.

2. Umpires assessed losses to their own unit only; not to the enemy.

3. Umpires neutral, non-partisan, *when acting as umpires.* (When taking part in an air raid or a fight, however, they did their best for their outfit.)

4. Attacks on enemy installations such as large bridges were umpired through the air director, one of the staff which directs and co-ordinates both sides. This air director arranged for a qualified ground umpire to be at the bridge over in enemy territory to judge the results of its bombing.

5. Ground umpires judged the losses or delays to ground troops or vehicles as the result of air attack.

Dummy planes often delude enemy into wasting bombs on burlap-covered frames. Although crude jobs on close inspection, they resemble airplanes from aloft.

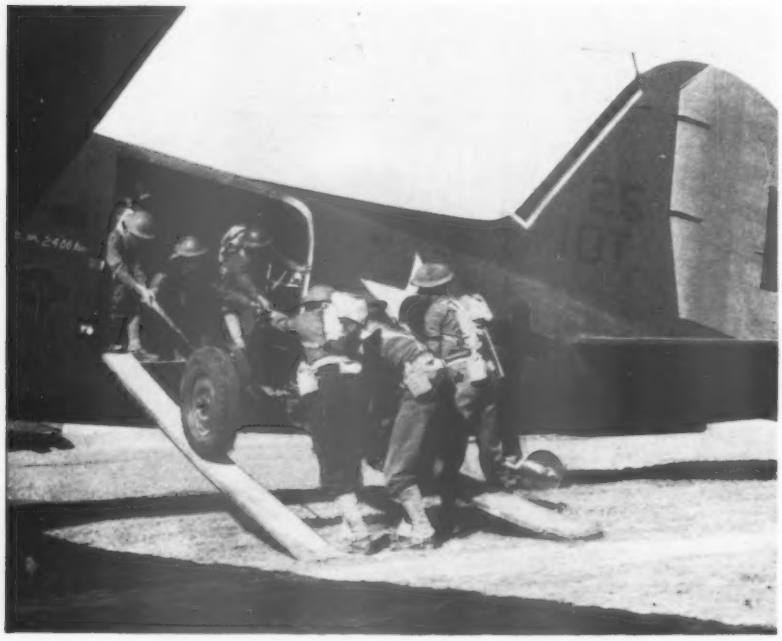
These Curtiss O-52 observation planes are simulating a bomb attack on bridgehead during First Army maneuvers. Umpire would decide that bridge and trucks are "out."

6. Antiaircraft umpires judged the losses to enemy aircraft as the result of their antiaircraft fire.

Only in the last two large scale maneuvers had progress in air-air and air-ground umpiring been rapid; especially in the latter type, such as the umpiring of antiaircraft action against airplanes or the effects and results of aerial bombardment against installations, such as bridges. Air-air umpiring is relatively easy and depends upon a definite set of umpire rules; but air-ground umpiring is so dependent upon effective and rapid communication that the previous pinching of funds for umpire communications prevented effective and rapid umpiring in such phases until quite recently.

A definite set of rules written under the guidance of Lieut. Gen. Leslie J. McNair, of Army General Headquarters, served as a guide for all air umpires. This manual prescribed among many other things, the method of umpire procedure, the length of time required for *simulated* loading of bombs in bombers between missions, the maximum number of missions per day each combat crew was allowed to fly or the maximum number of hours they could be held on alert or in readiness, the amount of damage a certain number of (simulated) bombs of a certain size could do to an airport and the percentage of planes on the ground those bombs would destroy, and the losses to formations of certain sizes and types during air combat with enemy formations of certain sizes and types. Also some of the finer points of umpire technique were contained in the manual, such as the note that a pursuit formation surprising another pursuit formation and attacking it is assessed only half the normal number of casualties, while the outfit which is surprised gets double the normal number of losses.

Light field piece is loaded into Douglas C-47 (converted DC-3) transport as airborne infantrymen prepare for lightning advance. Red cross is insignia of "enemy."



But let's imagine we are stowing away in the P-39D flown by Lieut. John C. Robertson, umpire of the Blue's 39th Pursuit Squadron, perching on the pilot's shoulder as he gives her the gun and lifts her up with the squadron, off at 10:50 a. m. on an interception mission in the 1941 Carolina maneuvers. He's flying a wing position where he can best observe what goes on for the entire formation. The squadron is shifting direction slightly in response to orders from the ground to correct its course to intercept the enemy. Far below them the ground maneuver area unrolls. An occasional enemy observation plane is sighted; fair prey at any other time but this. Then the orders over the radio from Lieut. M. L. McNickle, the squadron commanding officer; the enemy has been sighted; nine unescorted B-25's, evidently on their way to attack an important bridge whose destruction or damage would seriously delay the advance of the Blue ground forces. The formation of pursuiters race on, and, at 11:15, they make their interception and attack, hanging on long enough so that all pilots have been able to launch at least one assault on the Red bomb-luggers; so the bomber umpire knows his outfit has been attacked by 18 pursuiters. As the last screaming assault is started the bombers reach the bomb-release line, the leader releases a parachute flare to indicate to the ground umpire and antiaircrafters that his bombs have been dropped and the B-25's' noses point homeward.

McNickle also pulls his squadron away. At a lower altitude they return to their airport at Florence. Robertson glances at the card he has posted on his instrument board, 18P VS 9-10B—our losses three. He signals "three" to the leader, who promptly orders three of his pilots to drop back as "casualties." Instead of immediately returning home they are to accompany the formation to observe what goes on from there. The pursuiters can't linger too much on their return to the airport; they may be needed on another mission, but they *may* come across one of those enemy observation planes they saw—and that's what they do. An O-47, with a big red cross on its fuselage, coming along. Six peashooters pounce on it. Victory,—with no pursuit losses. The squadron re-forms and just before noon the P-39's drop back into their home airport. Most of the pilots rest, but not the umpire. Shortly thereafter he hands a message to a teletype machine operator whose sole job is to transmit and receive umpire messages from that airport to director headquarters. At this central headquarters, which umpires all umpires, both Red and Blue, the message comes in:

(*Continued on page* 86)

Pest trap (between wings) is weapon in Government's war on migratory insects.

BUG HUNTERS

by S. R. WINTERS

Traveling habits of crop killers is revealed as airplanes lead battle of entomology versus bugs.

AIRPLANES are holding the spotlight because of their leading part in the war between nations. But they are equally important, if less publicized, in the Department of Agriculture's battle with mites, spiders and insects which inhabit the troposphere (the air between the earth and the stratosphere) and, in their migrations, take tremendous toll of vitally important crops.

The "front" of this scientific war is located at Tallulah, La., down in the lower Mississippi Valley and 80 to 85 feet above sea level.

This country, so say the flying entomologists, is ideal for the business of collecting bugs in the air. In Madison Parish there are 80,000 acres of land under cultivation—most of it in cotton—and the soil is rich and fruitful. There are four times 80,000 acres covered with swamps and forests. There are hundreds of lakes and bayous hemmed in by cypress trees and Spanish moss. All of which makes that section of Louisiana the answer to an entomologist's loudest cry.

While chasing insects with airplanes may sound far-fetched, the Department of Agriculture is doing just this in a serious way in connection with studies on the migrations and control of various insects, particularly those affecting the cotton crop. Before the use of airplanes for this important work, science depended upon the use of tall buildings, hills, lighthouses and the erection of bug screens. Now our old picture of scientists equipped with sun helmets, goggles and swooping butterfly nets must be revised and streamlined. The modern entomologist sits in the cockpit of a specially designed Travel Air biplane. His nets are two insect "traps" fixed to the wings of the plane. They are placed between the wings of a biplane and under the wings of a monoplane. It is, of course, necessary to have the wing structure and supporting struts made stronger than is customary for ordinary flying to compensate for the added wind pressure.

In our increasingly significant strides toward greater and more efficient production of crops in this country, thorough understanding of the migrations of insects and the facts influencing them is highly important. Different species of insects have their peculiar habits of migration; some move from plant to plant, others from field to field, while still others have distinct migratory movements which extend thousands of miles.

Knowledge of the migrating habits of air-minded bugs enables our scientists to prevent the spread of new insects, permits checking harmful migrations at their source, and forewarns of outbreaks of crop diseases spread by insects in time to allow proper control measures to be taken. The use of the airplane has solved this problem of tracing routes and sources of insects.

All of which brings to mind—when is

Held in airstream, these plates catch plant disease spores carried aloft by wind.

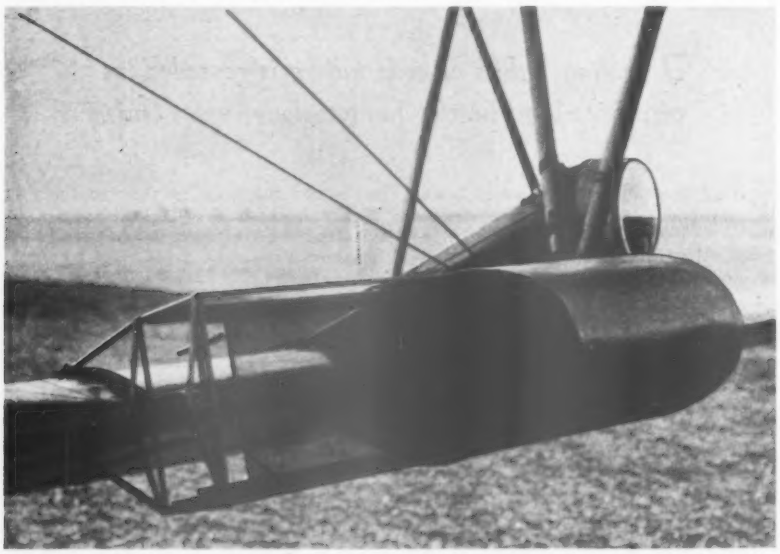
fresh air fresh? During 1,314 flights at Tallulah, or 1,007 flying hours, there were 30,033 different species of insects and spiders taken by these flying insect catchers. At altitudes ranging from 20 to 16,000 feet, specimens were taken every month of the year. The altitude of 20 feet was as low as any flights could be made with safety, and then only under the best flying conditions.

From the number of minutes in the air and the average speed of the several airplanes used, it has been estimated that 88,827 miles were flown in these insect hunts. Reckoning from take-off to landing, a distance was flown equal to six times the circumference of the earth, or 150,000 miles.

The flying entomologist has no idea what strange and peculiar creatures he will snag in his air nets. Dragonflies, those darting, gauzy-winged insects, seem to prefer a height of 7,000 feet. Dragonflies are something of flyers too, and frequently are seen to dart ahead of a "bug catcher" flying at 100 m.p.h. Termites abound at 3,000 feet. The *Thripsidae*, or flower thrips as they are known by the uninitiated, fly through the air with the greatest of ease at 10,000 feet in their migrations. This is an economic species which does much damage to young cotton and other crops. Tracing and controlling these insects does much to cut down their destructive onslaughts on cotton and tobacco fields. Lacewing flies and leafhoppers are found between 500 and 3,000 feet. And these represent only a fractional part of the flying and drifting insect world.

The size and weight, or buoyancy, of an insect determines the height to which it may be carried by the air currents. This relationship is best expressed in terms of aerostatic or lighter-than-air coefficient. The aerostatic coefficient varies with the area of the insect, which is exposed perpendicular to the pull of gravitation and inversely with the weight of the insect per unit of exposed area.

Each of three screens is exposed 10 minutes, then drawn into trap. Note fine mesh.



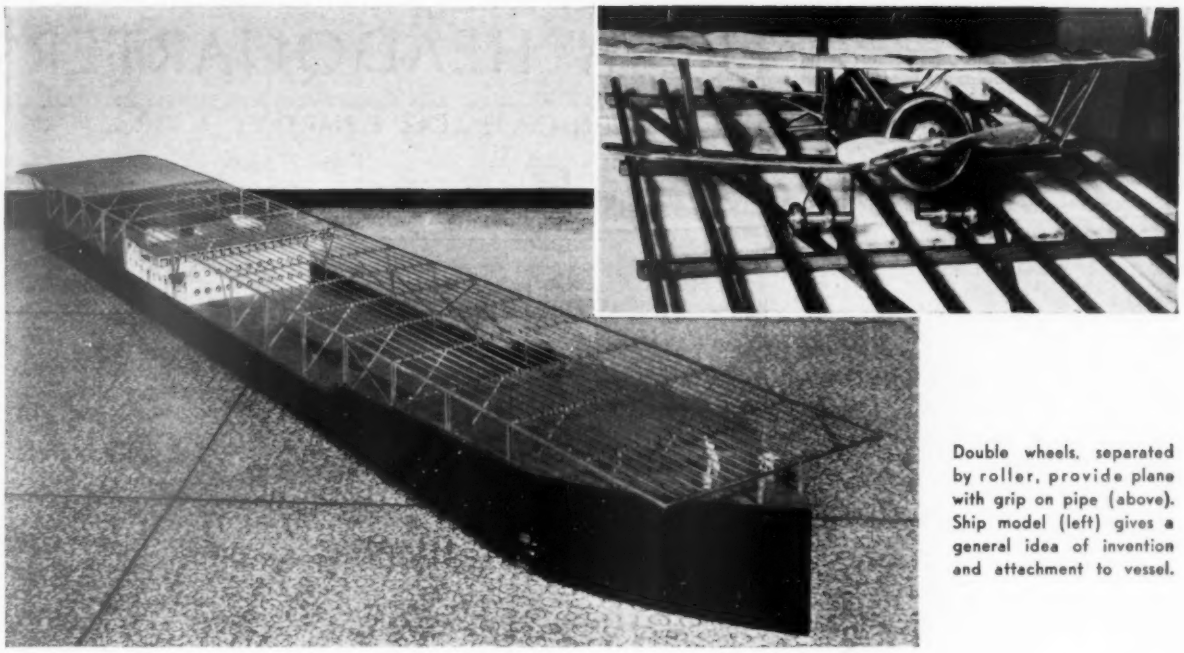
Insects collected in high altitudes, especially from 6,000 to 14,000 feet, occurred there because of their relative size and weight. Under the same given conditions of wind velocity and convection, a heavily built insect with small wing expanse will not be carried so high as a light insect with relatively greater wing expanse. It is probable that after insects are on the wing little muscular exertion is used to sustain the rate of speed. Insects on entering strong vertical currents may attempt to resist them by flying through these currents; otherwise they will be carried up from one level to another.

Strangely enough, spiders have been caught at altitudes of 15,000 feet. But then, spiders have definite aeronautic habits. Their webs can be seen in the air as high as 11,000 feet. At times, the wings of the "bug catchers" have been almost white with spider webs wrapped around them. Usually, it is the immature stage of a spider, known as a spiderling, which is addicted to air travel. It is quite possible for the huntsman-type spider to circumnavigate the globe with the aid of the trade winds. When taking off on his journey, the spiderling climbs to the top of a fence, twig, or any other elevated projection, lifts its abdomen to a 45-degree angle, with legs stiffened. It then spins out a thread, pushes its body forward, lets go, and is carried into the air and upward. It has been noted by the flying entomologists that the spider is able to regulate its course by drawing in its claws and the ends of the web until descent is effected. Spiders are well represented in the airplane collection of insects.

Insect hunts and expeditions are undertaken night or day. Before take off, the trap is "loaded" with five unexposed fine-mesh wire screens. The trap is in three sections, two closed and one open. The frame is steel tubing. A steel wire runs from each screen to the rear cockpit, from which it is controlled. After the desired altitude is reached, the first screen is pulled into the open section of the trap where it is exposed for the desired length of time, usually 10 minutes at a given speed. It is then drawn into the third compartment and protected from further exposure. The remaining screens are exposed in like manner. The ends of the frames of the screens fit tightly and completely close the openings to the sections. In this way, insects are prevented from reaching the screens before and after the proper elevation has been reached and exposure made. Insects are removed immediately after each flight and placed in glass tubes, properly labeled. Special flight records are kept for each flight.

There is much evidence to support the conclusion that many of the insects and mites collected in the upper air, at altitudes as high as 15,000 feet, were "taken alive". Many specimens were still alive when removed from the screens. A mosquito taken at 6,000 feet "was able and willing" when removed. Great care is used in coating the screen catchers with a thin spread of adhesive to retain and

(*Continued on page* 106)



Double wheels, separated by roller, provide plane with grip on pipe (above). Ship model (left) gives a general idea of invention and attachment to vessel.

A Mass-Production Carrier?

by BEN H. PEARSE

Speed and economy in creation of auxiliary aircraft carriers is aim of pipe-line landing deck designer.

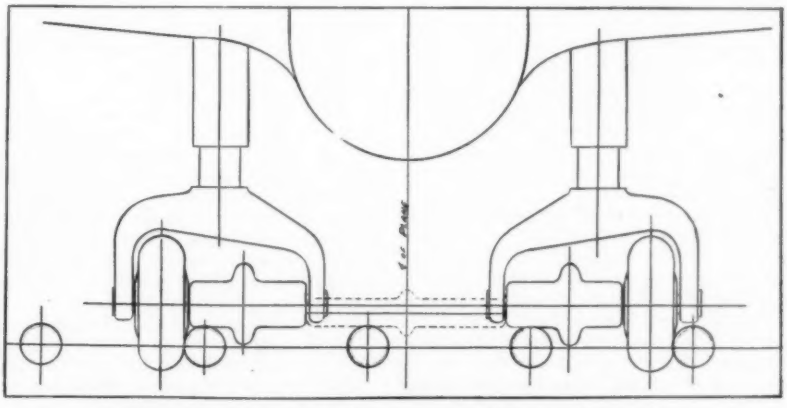
SPEEDY and economical conversion of commercial vessels to serve as auxiliary aircraft carriers by means of a superstructure built of standard size oil well casing, is one of the most interesting of countless devices and inventions submitted to Naval authorities at Washington since the entry of the United States into the war.

Created primarily as a means of providing suitable landing facilities for the inventor's own plane in an otherwise unsuitable, mountainous location, the plan also involves a slight alteration of conventional landing gear. If the proposal proves practical, it is possible that the United States may create in very short time an auxiliary aircraft carrier fleet which would, in effect, make every coastwise or ocean-going vessel self-protective as well as a potential offensive unit.

The inventor is not an engineer, nor is he particularly concerned with aeronautical research. When he first started work on his oil well casing landing deck he was not thinking in terms of aircraft carriers. He is a pilot, part-owner of a school now training flyers for the Army Air Forces. An occasional interest in oil field development accounts for his adoption of oil well casings as the basic feature of his device. His name is John B. Quinn and he lives in West Los Angeles, Cal.

Quinn has had several planes of his own since he began flying in 1921. He first associated oil well casings with landing decks when he faced the problem of creating a landing field near his hunting cabin in the Sierras. A fairly level tract nearby would have been satisfactory if it had not been for hummocks, hillocks and boulders. Quinn first considered stretching cables from equal elevations, but the inherent sag of that material made such a plan infeasible. It was then his mind turned to oil well casing, with which he was familiar. A pipe does not sag like a cable. Why not make his landing field out of pipe?

Quinn rigged up a rough model and showed it to a friend with the CAA on the west coast. He thought Quinn had something. Landing fields for commercial airplanes have to be far from the center of large cities. A landing strip of this pipe might be laid across the tops of buildings in the downtown section. Because of its lightness and the inherent strength of the cylindrical form, no insuperable engineering problem would be involved. Thus encouraged, Quinn took his brain child to the A. O. Smith Company, of Milwaukee, Wis., one of the



Landing gear roller rests on pipes, prevents plane from side-slipping.

most experienced firms in its line in the country. There the practical details of stress and strain, the design of the supports and the couplings were worked out by engineers and put in blueprint form as shown on the accompanying drawings. Then the war broke out and Mr. Quinn went to Washington.

In brief, his landing deck consists of parallel lines of standard size oil well casing, eight and five-eighths inches in diameter, spaced three feet apart. Fifteen of these lines would make a landing strip 45 feet wide, about the beam of a tanker or average size cargo vassel. That would be adequate for a landing, Quinn believes, but as many more lines could be added as the ship's beam would allow. By adding standard 20-foot lengths, the strip could be made 400 or 4,000 feet long, longer if desired and space is available.

To lift this landing grille, which would be supported by fastenings attached to the under side of the pipe to allow a smooth surface on top, the landing gear would have to be altered only slightly. In place of a single wheel on each side would be a double wheel, one of conventional size for conventional ground landings, and the other slightly smaller in diameter. Separating the larger and smaller wheels would be a roller the same width as the diameter of the pipe and inside the smaller wheel another roller the same width. By the proper spacing the plane lands either on the two larger wheels or the two smaller wheels, and then drops down onto the rollers because of the roundness of the wheels and the pipes. It may, of course, land on the rollers in the first place, saving the drop of a few inches, perhaps as much as the depth of a rut on a dirt field. Once on the rollers, the wheels act as a flange on either side, preventing the plane from slipping sidewards, even though the deck be inclined at an angle of 30° or more, and also preventing it from ground looping. The tail assembly consists merely of a wheel with a roller on either side wide enough to span two pipes.

The principal advantages which Quinn claims for his design are its lightness, the availability of materials and the ease and speed of installation. The entire weight of the installation on a 400-foot freighter or tanker he estimates at about 300 tons, including the standard Navy arresting gear, less than one-fifth of the conventional type landing deck. It is made principally of a type of pipe which many steel mills are ready to start producing immediately without any further preparation. The standardized parts are readily interchangeable, Quinn points out, and less remodeling need be done to convert a vessel than with the conventional design.

The Second World War began as a war of armies and land based air power. From the Polish campaign in September, 1939, and continuing through the fighting in Norway, the Low Countries, France, the Balkans, Russia, Libya and even Crete, these factors dominated. Naval forces were engaged, in the convoy service which kept open the vital supply lines to Great Britain and later the

(*Continued on page* 104)

FROM HEADQUARTERS

by Lieut. Col. HAROLD E. HARTNEY (A. F. Res.)

Harold E. Hartney

THE "busy" signal at the War Department, at the War Production Board and the Navy makes one curse but reveals the barometric pressure of work here. Mighty exasperating when one hears the connection all right and then after hearing the number ringing for some 60 seconds, on comes the "buzz-buzz." If that buzz-buzz would only come at once to indicate the line was busy, it would not be so bad. But with 250,000 calls per day, if 20 per cent of them waste one minute per call, 833 hours are lost here daily in this one, seemingly unimportant, manner.

* * *

Most readers appreciate that foreign pilots who have flown the Army P-47 *Thunderbolt* are keen about it. Some of them in their enthusiasm claim it is the best fighter in the world. The *Thunderbolt* must be good, for here are some of the data officially released on the best British fighter. It is the Hawker *Typhoon* created by Sidney Camm, who gave the RAF its *Hurricane, Fury* and the *Hart,* each supreme in its day and class. The *Typhoon* is a compact low-wing single-seater equipped with a Napier *Sabre* 24-cylinder H-type engine. The *Sabre* is one of the world's most efficient proven (in production) engines. Its efficiency is obtained by a high r.p.m. rate and high brake mean effective pressure developing 2,350 h.p. for take-off and 1,800 h.p. at rated altitude. The plane travels more than 400 m.p.h. top but its greatest asset is its high altitude performance and speed of climb and dive. The RAF officers take pride in pointing out that the *Sabre* develops more power than the engine which pulls the celebrated London to Edinburgh train, *Royal Scot* (exhibited at the World's Fair, New York, two years ago). Its armament would make even a tank camouflage itself green—with envy. If our *Thunderbolt* is better, it sure is some ship!

* * *

Your correspondent has an extra bedroom in his office suite and has been fortunate in being able to save officers from a park bench on occasions when a hotel room was impossible to locate. Already from the 10 expeditionary forces mentioned by the commander-in-chief, postcards are beginning to arrive from some of these guests. This surely is a globular war!

* * *

It won't be necessary for the advocates of a separate air force to lobby any more. With six billion dollars for the Navy and nine billion for the Army Air Forces, together with all the personnel, fields and "what-not" that connotes, the Army and Navy are beginning to put up a fight for a separate Army and a separate Navy!

* * *

General Hershey, director of selective service, caused quite a sensation here when he warned the nation that its supply of manpower is not as endless as many people think. Already he has demonstrated a balanced liberal attitude on this vital subject by releasing essential key-men of the motion picture industry from the draft. He appreciates that certain businesses, and key positions therein, are more important than foot-slogging. He bases his whole policy on two objectives, both inter-related:—raising an Army and producing the war goods. People here in Washington will be happy when all the "top men" follow this broad, sound line.

* * *

Dozens of men representing small businesses have been in Washington attempting to prevail upon Donald Nelson, head of the War Production Board (successor of OPM, the Supply Priorities and Allocations Board, the National Defense Advisory Committee and all the off-shoots of the original War Resources Board of August, 1939). They want him to take all production, except experimental, away from the Army and Navy; get the appropriations into his own hands, allocate it himself through a decentralized industrial control utilizing every little machine shop and employing every man possible for production.

These crusaders point out that most of the contracts handed out by the services have gone to big business (over 75 per cent to 56 of the 180,000 manufacturing establishments in the United States) and they claim that often in the past attempts have been made to revive the work of old communities where some special line had succumbed to changing national economic conditions. The Army ordnance department made a survey of prospective plants and found 89 per cent (850 out of 960 plants inspected) were convertible to ordnance production. A very influential man has remarked: "Will he (Nelson) fight to protect the United States or certain entities within the United States?" Nelson already has an executive order which gives him complete and unequivocable authority. He can do anything.

* * *

"Washington has become a megalosaurian city, its body all out of proportion to its brain," said one prominent visitor here. "The staggering and unwieldy size to which it has been swollen by the ill-considered effort to make it the industrial as well as the political capital of the nation explains much of the confusion and congestion that impede war production." A committee of the Senate is working especially on this one phase. The Truman report went over the heads of the American public largely be-

(*Continued on page* 100)

Disney Artist Henry Porter at work on designs which now adorn planes, ships and men.

A pugnacious American eagle in fighting stance identifies Eagle Squadrons of RAF.

★

Ferocious tiger typifies spirit of AVG's, heroic Yank pilots defending Burma Road.

INSIGNIA INDUSTRY

by KURT RAND

Walt Disney's artists work tirelessly as requests for aviation caricatures swamp special department.

WALT DISNEY, the pappy of Mickey Mouse, Donald Duck, Dumbo and an assorted collection of strange characters who cavort across the screens of a nation, has taken on a part-time job which bids fair to become an industry of itself. The new "industry" is strictly non-profit, patriotic and a help to the morale of our armed forces.

Disney is not only patriotic, but he is air-minded. He flies wherever he can. And, what's more, his huge new plant in the San Fernando valley is virtually bounded by the Griffith Park Airport of the California State Guard, Grand Central Air Terminal (on which operates a primary training school of the U.S. Army Air Corps), Lockheed Airport and Lockheed Air Terminal, plane testing base and western terminus of all transcontinental airlines.

He's come to admire the daring young men who practically blacken the skies directly above his big new studio. More than that, he's wanted to be of service to them.

Naval Reserve aviation base at Atlanta, Ga., obtained coveted Donald Duck emblem.

Capt. Elliott Roosevelt wangled Dumbo for Sixth Reconnaissance Group, Newfoundland.

Elephant poises, ready to "put the shot" for 40th Bombardment Group, Puerto Rico.

The Ellington Field, Tex., bombardment training group got this infant prodigy.

And, June, 1939, a letter showed up on his desk which told him exactly how he could contribute to national defense. The letter was from Aviation Cadet Burt Stanley, USNR, who was in training at San Diego.

"During the last World War," Cadet Stanley wrote, "various aviation squadrons had their own insignia, such as the 'hat in the ring' design used by Capt. Eddie Rickenbacker. Today, we don't have clever ones, the kind needed to kick up our morale and give us a feeling of personal pride in our outfit. Why don't you design us a suitable insignia?"

He suggested that Disney might get off to a good start by designing one for an aircraft squadron aboard the new Navy carrier, the *U.S.S. Wasp.*

"You bet I can," Disney replied. He turned the job over to an artist named Henry Porter, better known to the hundreds of Disney artists and his boss as "Hank." One of Porter's men went to work and from his facile pen came a magnificently belligerent wasp, a wasp who really meant business.

The wasp suddenly blossomed out aboard the aircraft carrier. It went on planes, flying jackets, mechanics' uniforms, letterheads and anything else handy. And it wasn't long before the Disney insignia was known from coast-to-coast.

And what happened?

Just what you'd think. The lads who saw the wasp wanted something of their own. Requests started to pour into the Disney studio almost every day. Disney summoned Porter.

"Mister," he said, "you have yourself a job. Just settle down to it. Make as many insignias as you can. If you get overloaded with work, let me know."

At this writing, Hank Porter has outgrown one room, and he works in three. On the staff he has organized are Van Kaufman, a very talented young man from Georgia, who went to art school in Los Angeles and who has been working at the big Disney plant two and a half years; George Goepper, skilled drawer of Pluto the pooch, and Ed Parks, a Connecticut boy who has been with Disney for four years. Of the lot, Parks is the only one who actually flies, having taken instruction in Connecticut. Kaufman used to build and fly model airplanes, however, and is in the spirit of the thing.

Disney says:

"Never mind what the job is costing us. That isn't important."

However, you can rest assured that the company at present is spending four figures a month on the department which Hank Porter has created. So far, more than 200 insignias have been turned out for the Army, the Navy, the Marines and

A rampant Indian is Disney's idea of the 16th Reconnaissance, Fort Douglas, Utah.

A sea-going Donald Duck proudly reigns over British carrier "H.M.S. Illustrious."

Ready for action, a fighting cock marks Selfridge Field, Mich., pursuit planes.

A jubilant hippopotamus happily tosses bombs for the 43rd Bombardment Group.

Identity of this scrappy individual is easily guessed. He's the "U.S.S. Hornet."

This wasp for Fighting Squadron Seven started the Disney series of insignia.

for various Governmental bodies. Working as hard as he can with his three co-artists, Porter nevertheless is more than 200 behind.

"But we'll catch up," he declared, with a grin, when I went to visit him in his three-room workshop. He was very busy working on a design requested by Capt. Elliott Roosevelt for the Sixth Reconnaissance Squadron. He showed me the quaint flying elephant, "Dumbo," from the full-length animated cartoon from the same name. Dumbo, a fat little dwarf elephant with huge ears, learns that he can use them to take off, zoom and do a few acrobatics.

"We have been informed that up to now no commercial characters could be used in the designs," Porter explains. "That is why, to date, Mickey Mouse, Minnie, Donald Duck and a few others in the Disney family haven't appeared. Naturally, it might look as if the various branches of Government were advertising the Disney product."

Disney certainly isn't advertising anything. He is only trying to do a good job. Dumbo was allowed to pass muster because he isn't a permanent Disney star, like Pluto, for instance. Dumbo was in for just one picture, and it has been released.

So, you are hereby notified in advance that Captain Roosevelt is going to get Dumbo for the Sixth Reconnaissance Squadron, and that Dumbo will be holding a spy-glass, which carries the thought that the Sixth, although a bit large, nevertheless is both graceful and on the alert.

At the same time, on another board, is coming into being a job for the First Defense Battalion, part of the group of heroes who received a citation for the defense of Wake Island against the surprise-attacking (to put it mildly) Japs. The design isn't far enough along to make a definite report on it.

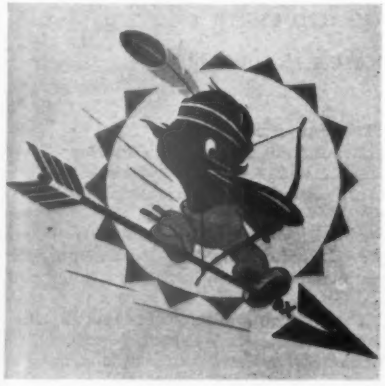
"It seems that the designs find a lot of favor," Disney says, "because they have a tendency to knit a squadron or a battalion or whatever organization they may be drawn for, closer together. The group is just a group until there is something to 'pin it together' and then it becomes a real machine. Other groups challenge it and they too get into a fine competitive spirit. The design represents the same thing today that the red 'kerchiefs worn by General Custer's Seventh Cavalry did in the Civil War and later in Indian fighting. The general wore one, soon everyone was wearing one. The men were proud of the scarves, held those who wore them equal, and boasted that they could lick any outfit of similar size in the world. That's the kind of spirit

(*Continued on page* 90)

Air raid wardens of Greenwich Village, N. Y., are known by this special design.

☆

Straight as the proverbial arrow goes the 77th Bombardment Squadron's bomb.



Typical of Gray Field, Wash., Air Base Detachment is this energetic, busy bee.

The P-40 carries a wallop. So does this insignia of the 45th Air Base Squadron.

The RCAF

Eight airports and 70 planes have grown in two years to an air force of 6,000 training ships, 72 modern air centers.

by DON R. RAE

Photographs from Warner Brothers

Starting from scratch in 1939, Canada has created an impressive and highly efficient aerial war machine to train the empire's flying men.

FROM a forlorn total of only eight improved airports to a total of 72 completely modern and equipped air centers in the course of two inspired years;

From a collection of not more than 70 obsolete planes to an air armada of more than 6,000 training ships;

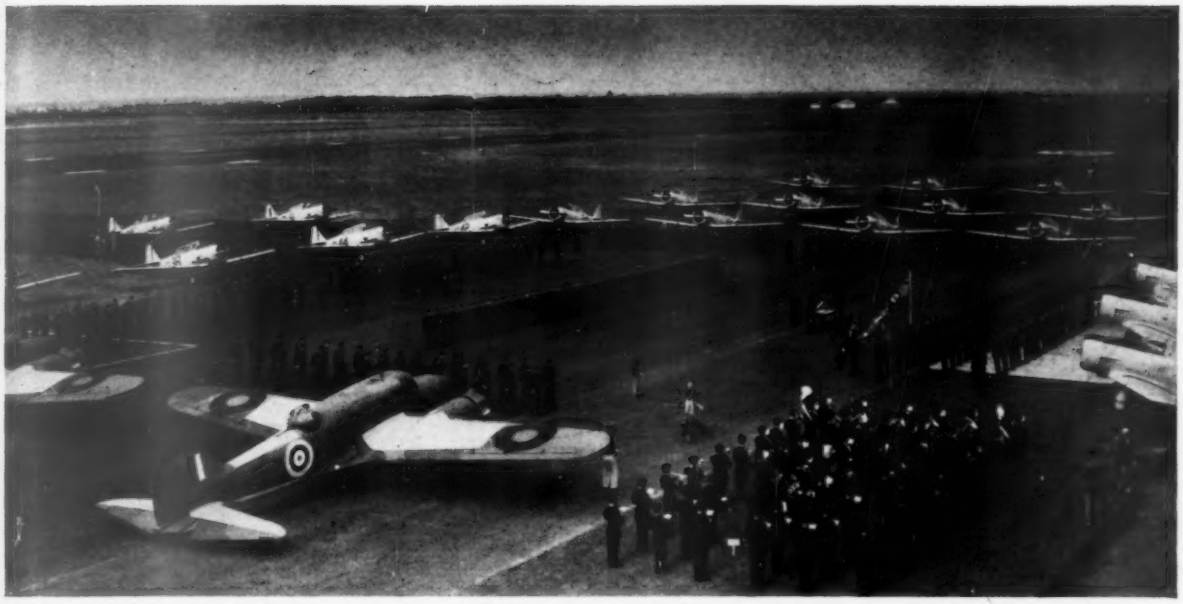
From small and inadequate Atlantic and Pacific coastal patrols to 26 squadrons of pursuit and bombing pilots, now being organized, to serve as an integrated RCAF force overseas;

From 170 pilots to a total of 2,500 highly trained soldier-pilots fighting both in Europe and in the Near East, and an estimated output of 900 pilots per month;

From a personnel of less than 2,000 on the ground and in the air to a vast training force of 250,000:

This, in brief, sums up the amazing speed with which the Royal Canadian Air Force has developed and expanded under the Joint Air Training Plan launched soon after Great Britain declared war on Germany in September, 1939. Into a vast aerial melting pot have gone Canadians, Australians, New Zealanders and Americans. It is estimated that 10 per cent of the entire RCAF is American, thanks principally to the famed Clayton Knight Committee (now the Canadian Aviation Bureau) which has disseminated information throughout the United States.

The foregoing data comes from Squadron Leader Owen Cathcart-Jones, famed British naval and commercial pilot, a Staff Officer in the Directorate of train-



Single line, center, is RCAF graduating class. American "Harvards," "Yales" and British Avro "Ansons" form hollow square.

Owen Cathcart-Jones

ing for the RCAF, and recently assigned to act as technical advisor on the Warner Brothers motion picture, "Captains of the Clouds," which tells the story of the growth of the RCAF with the foreground of action revolving around "bush flyers" who enter the service.

Much of the film was taken at the Number Two Service Flying Training School at Uplands, Ontario; at the Central Flying School at Trenton, and at the Atlantic base near Halifax.

Squadron Leader Cathcart-Jones has had a varied and exciting career, with about 3,500 hours of logged time behind him. Born at Insch, Scotland, June 5, 1900, he attended preparatory school until he was 13 and then became a naval cadet. For the next 17 years he was in the navy, with six years in the Fleet Air Arm, holding the rank of Lieutenant. He flew from the *Glorious*, the *Eagle*, the *Courageous*, the *Hermes* and the *Argus*. He resigned in 1930 and, as a civilian pilot, flew with Glen Kidston. Among his sensational flights were from London to Capetown; from London to Malta; from London to Melbourne, and several South American demonstration flights. In addition to making record flights, he acted as technical advisor to producers of motion pictures in Great Britain. From 1936 until 1939 he spent most of his time in Mexico, but hurried to Canada to offer his services to the RCAF when the war started.

"In the beginning," he declared today, "the RCAF, now the pride of all Canadians, had only the nucleus of an air force. There were but a few Noorduyn *Norsemen*, Fleet biplanes, Fairchild 71's, Bellancas on floats, and flying boats.

"Personnel was about 2,000, including both airmen and groundmen, or aircraftsmen.

"There were but eight fields, three of which were well developed. These were Camp Borden (now the senior member of a group of 26 service flying training schools); Rockcliffe, which is devoted to test and development work; and Trenton, the central flying school."

Today, a complete training schedule is in full operation, consisting of initial, elementary and service stages, roughly corresponding to the American system of ground, primary, basic and advanced stages. Graduates have approximately 265 hours, which is 55 more than fledgling U. S. Army Air Forces' lieutenants have when they receive their commissions.

The breakdown of the four stages of training is as follows:

Initial (ground)—four weeks. During this period physical and mental tests are given, which results in cadets being sent in three directions, (1) pilot, (2) air gunner, (3) observer.

Elementary (primary and basic)—four weeks. This includes training for solo, and solo flight.

Service (advanced)—two months. Advanced flying, including instrument work. Pursuit pilots go to single-engined jobs, bomber pilots to two-motored jobs.

Overseas (combat training)—five weeks. Here, pilots "polish off" with an actual bombing flight, flying as co-pilot, or actual participation in a fighter patrol before final graduation.

Oddly enough, only 10 per cent of the graduates are commissioned as officers. The other 90 per cent are ranked as sergeant pilots.

"The RCAF believes that this system, rather than granting of commissions to

Air Marshal William A. ("Billy") Bishop, famed World War I Canadian ace, and staff review RCAF cadets. Note American "Harvards," "Yales" in rear.

everyone, inspires a greater spirit of competition," Cathcart-Jones declares. "The sergeants gradually get commissions. The original commissions are granted as a result of excellence in all phases of flying. Pilot officers receive about $120 a month, as compared to a flight lieutenant's pay of about $245 in the United States. However, a great many allowances are made, which brings the pay well up. Pilot sergeants receive slightly less than the officers."

Cathcart-Jones declares emphatically that there is no shortage of candidates—that, in fact, the Joint Air Training Plan, being the pet of the Canadians, is receiving more than enough man power.

"We require what corresponds to a high school education," he says. "We've so many superior candidates that it has not been necessary to call up even what one might call 'first class men.' It is heartbreaking to turn down some of the excellent material we do.

"Educationally and physically, we believe that we have the finest fighting product in the world today.

"The estimated cost of training a pilot is about $25,000, which is about the figure arrived at in the United States during World War I."

The Australians and New Zealanders arrive with a background of elementary training. Many of the United States candidates have had some flying experience, most of it in CAA primary and secondary schools.

"The need of instructors is our bottleneck," Cathcart-Jones declared. "We do not have enough for the elementary (primary) training. The elementary schools are operated by private enterprise, much as in the United States. We return some of our best pilots to these schools to act as instructors.

"The Canadian Aviation Bureau has been of invaluable aid in getting instructors from the United States. As an experiment, we accepted 25 apprentice instructors, mostly from California, with a minimum of 150 hours of instructional experience. This was successful, and we could use many, many more."

Instructors are accepted up to the age of 45 years. Those wishing to enlist in the RCAF for flight training, however, must be between the ages of 17½ and 28 years. At the present time, there is a need for air crews, and the Canadian Aviation Bureau is working on the United States phase.

The new plan for the development of the 26 fighting and bombing squadrons to be organized and sent overseas is the result of popular demand in Canada, both among the civilians and among the pilots themselves. Until recently all activity was directed toward training, with the overseas pilots being infiltrated into RAF squadrons, with the result that pilots were losing their Canadian identity.

"The new squadrons will give Canada a chance to show that its pilots can fight and bomb, and the achievements of these squadrons will be Dominion achievements," Cathcart-Jones explains.

The growth of the air centers is one of the most amazing in military annals.

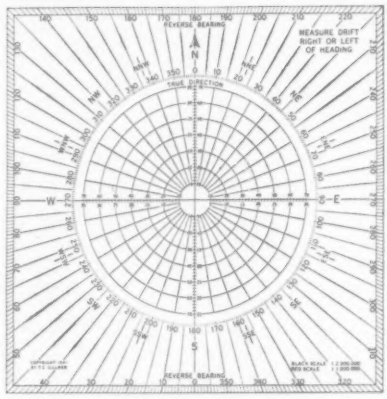
(*Continued on page* 102)

★ A NEW COMPUTER ★

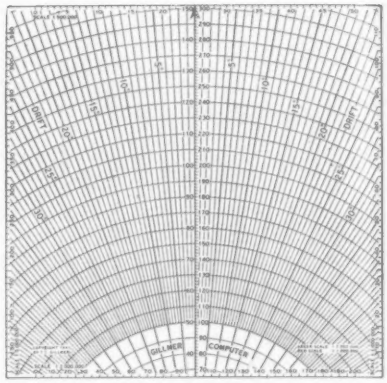
by T. C. GILLMER

Designed by the author, this calculator simplifies navigation problems, is accurate without being complicated.

A NAVIGATIONAL computer may seem to be a little thing, but, like a chart, compass, or other instrument, it is an essential "tool of trade" to the pilot. But also, to the student pilot, like a text book, it is an adjunct to his study. It is doubtful whether the pilots on our fighting fronts will be restricted in the use of instruments so as to make them available for training purposes, however. In the light of this contingency the new "Gillmer computer" has been developed by the Weems System of Navigation, of Annapolis, Md. Its design is similar in basic principle to all higher grade computers and plotting boards (Army pilots will recognize a marked similarity to the Dalton model "J"). This new computer has the great advantage, however, of being easily manufactured on a quantity basis with the consequent low cost. No more expensive than the average text book, it contains the features and operating principles of computers priced in the neighborhood of $40.



Wind and bearing grid.



Drift grid.

Simply, it consists of two frosted transparent plates, unattached but to be moved face to face to form the required setting. The fact that these two plates are not attached makes possible the simplicity in manufacture, requiring no precise and tedious centering and pinning together of a series of discs, common to other types.

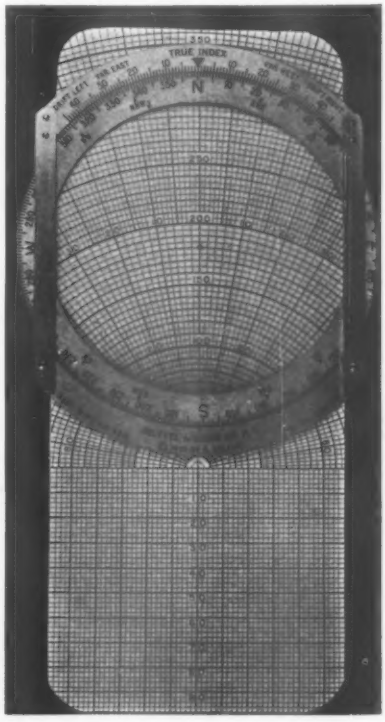
The unique features of the new Gillmer computer are briefly: two plates, wind and bearing grid (a) and drift grid (b). The reading is always made directly at the center, with no searching or getting lost. The scales are two and conform to the sectional and regional aeronautical charts, thus making it possible to set up the problem directly over the chart. Additional scales for plotting and expanding problems are found on the outside edge of the drift grid plate.

As a training computer it will have the marked advantages of quantity production, simplicity and instructiveness in the basic principles of all computers and plotting boards. In addition it will release expensive types to actual wartime use.

As a practical computer outside the classroom, it is more accurate than most. It has the adaptable advantage of wide speed range, both low and high. Such range will cover any civil and most military aircraft. The identifying colored scales, easy to read size (7½" x 7½") and basic design should render it a higher useful instrument in the hands of the pilot as well as student.

END

The Dalton Model J.



A STUDY OF TAILLESS AIRCRAFT

by RAOUL HOFFMAN

THE recent successful flights of the Northrop flying wing may mean the practical solution of the all-wing airplane problem. Few of the previous tailless jobs that took to the air showed any marked improvements over the airplanes of conventional designs. Usually the rudder area was larger than the area a regular tail would require.

There should be a distinction in naming an airplane a flying wing or an all-wing airplane. All airplanes are flying wings. Therefore an airplane having no tail should be called a tailless airplane, even if it had one or more rudders, and an airplane in which everything is an integral part of the supporting wing, such as cabin, control surfaces, should be named an all-wing plane.

One of the most successful flying wings is pictured in Section 1. It was designed by Vincent Burnelli, an American engineer, and built in England. Recently it made a 6,500 mile nonstop flight. The increased chord between the booms will retain the same aerodynamic efficiency as the outer portion of the wing.

The problems of a tailless airplane are manifold. Experiments with paper models, shown in Section 2, will help to understand the complex nature of an all-wing airplane. Many designers add too many control surfaces in order to make sure of its maneuverability, thus adding more drag than the regular tail would have.

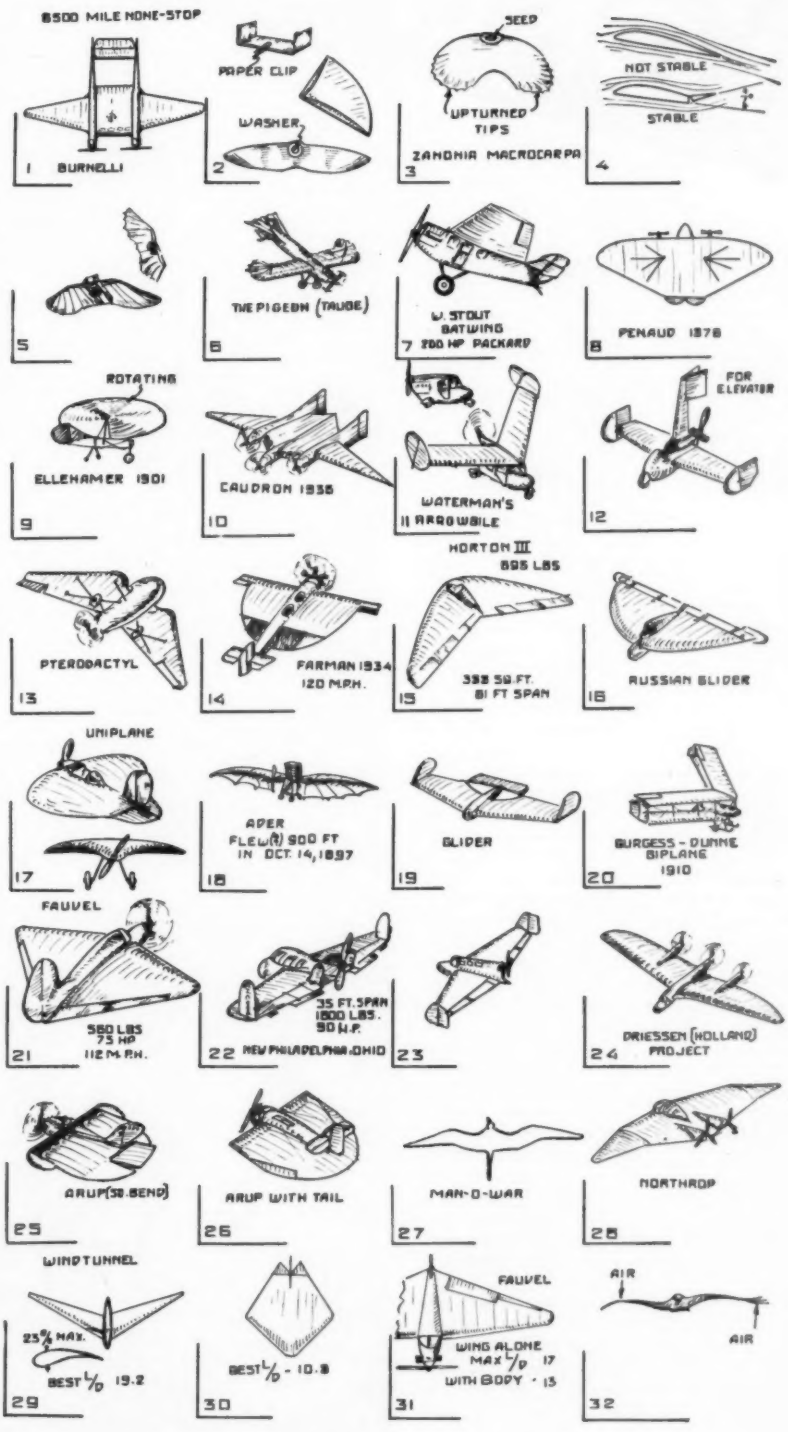
Nature gives us a few examples of tailless jobs that may be studied. Some birds retract their tails when soaring. Even bats may be classed as tailless creatures.

There is, however, an example of a tree that sends its seeds to a distance of one to five miles by adding a thin membrane for a gliding surface. It is the leaf of the *Zanonia Macrocarpa* of Java. A sketch in Section 3 shows its upturned tips (washout) to give the necessary aerodynamic stability.

The regular airfoil sections have no longitudinal stability except at very low aspect ratios. The Clark Y must have its flaps turned up at least 7° before it becomes stable. The efficiency and the lift of the wing however will drop considerably. This is made evident by the fact that the upturned trailing edge returns the airstream to its original position, as shown in Section 4.

The previously mentioned *Zanonia* leaf was used by Wels of Czechoslovakia to develop two gliders. The public appearance of the Wright brothers was instrumental in Wels' decision to install an engine in a man-carrying glider, which he named the *Sparrow*. But even an additional frontal elevator control surface did not lift the plane off the ground. Etrich, the financial backer of Wels, added a flexible tail surface and increased the aspect ratio of the main wing. This plane, named the *Pigeon*, made its first hop in 1909 when most of the countries already had their successful

(*Continued on page* 102)



Interest in tailless craft (sketched above) is rekindled by Northrop flying wing.

LONG DROP

by

A. W. BERNSOHN

A former barnstorming daredevil enlists the aid of scientists to prove practicability of free falls from the sub-stratosphere.

POWERFUL lenses are trained on the plane, just a speck at the sub-stratosphere altitude of 30,800 feet. From the plane falls a tinier speck, a human body. It plummets rapidly toward earth. For more than two minutes it falls with parachute unopened. Downward it plunges until about 1,500 feet from the ground. Then one parachute mushrooms out. Then another; and the jumper settles safely to the ground.

It's Arthur H. Starnes—and his scientifically planned, record-breaking free fall.

When Starnes was a kid, he was just another daredevil barnstormer flying about the country with men like Roscoe Turner, Bob Shank, A. B. McMillan, Clyde Pangborn, Dixie and Doug Davis, Eddie Stinson and many others. He did wing walking, changed planes in mid-air, performed on rope ladders, made intentional crashes and some unintentional ones. Once, at Huntington, W. Va., he dove 100 feet into a river from a plane throttled down to 65 m.p.h.! In 1925, he took his first delayed-opening jump, a free fall from 5,000 to 2,500 feet. This was one of his most sensational stunts, since he was a pioneer in this type of leap. By 1928 he'd perfected his ability to the point where he could leap from 9,000 feet and not open his 'chute until spectators were ready to faint from tension.

Then he got the idea that if the body were protected from the elements and given oxygen, a properly trained jumper could eliminate the fear barrier that kept the free fall so dangerous. He was one of the few who believed that the human

Cumbersome, but each device played an important role in recording jump data.

body could fall indefinitely without losing control of mental and physical faculties.

But those daredevil days were long ago. Now Starnes is more a scientist than a stunt man. He is a real estate expert, a member of several lodges, a family man whose wife and son confidently expect him to return home regularly in one piece despite his risky sideline of parachute jumping. Today, at 36, the 190-pound expert has about 300 parachute jumps in his experience kit, 56 of them being free falls through an average distance of 7,000 feet from altitudes up to 18,500 feet—not including his stratosphere jump. Many of his previous free falls also were made under expert scientific observation.

Once Starnes settled down to the quiet life of a Calumet City, Ill., real estate man. But the information he had about jumpers not blacking out when they fall kept stirring in his mind, shaping into a complete, well-rounded, scientific theory. It wasn't quite complete for a long time, until the so-called "have not" countries started acquiring neighboring land. A new sort of warfare came along.

Then it all became clear to him:

The free fall is a valuable military technique. It can save lives of pilots forced to abandon ships. And pilots and members of air crews are too expensive to waste since it costs a country $20,000 to $25,000 to prepare a pilot for first line duty. There's no chivalry in this war like there was in the last. No more can a defeated birdman dip his wings and bail out unmolested. Actual cases have already been recorded of American pilots being riddled with Japanese bullets as they swung helplessly from their chutes.

If a pilot delayed opening his 'chute until he was within 2,000 or 3,000 feet of the ground, the enemy plane's gunfire would find him a difficult target in the air. Also the enemy would hesitate to attack him after he did open the 'chute because of fear of antiaircraft fire at low altitude.

Starnes examines pneumagraph which is worn attached to breastplate (note in foreground) and records respiration. Equipment brought weight to 285¾ pounds.

Furthermore, the free fall permits the body of the jumper to decelerate to a safe speed. While you can't very well get out of a modern warplane going around 350 m.p.h., you can jump from one going at 200, Starnes reasoned. The body then becomes a projectile. The shock load of an immediately opened 'chute would be tremendous at this rate, almost certain to severely injure the jumper. A suddenly opened 'chute, attached to a man who has just left a speeding plane, might have to withstand a shock load of 5,000 pounds! One Navy man didn't let his body decellerate in such a jump and opened his 'chute immediately. His straps broke and he crashed on down while the burdenless parachute floated lazily to earth.

Starnes believed that a 200-pound body would not exceed a speed of 130 or 140 m.p.h. at 2,000 feet after a considerable free fall. If the 'chute opens at a descent faster than 150 m.p.h. there's a strong chance of injury to jumper, harness and canopy.

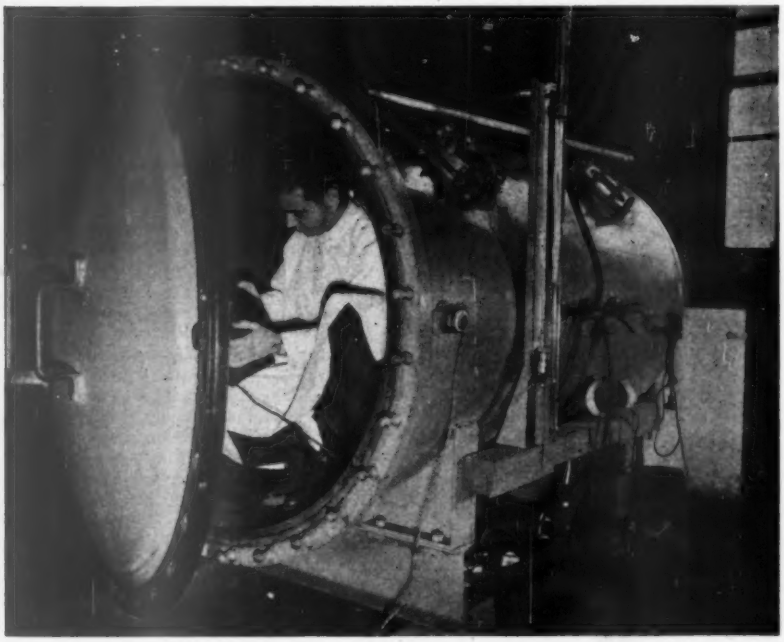
Another advantage Starnes envisioned was minimizing the danger of the pilot colliding with his disabled craft or parts of it, since it stands to reason that an airplane out of control won't follow the exact path of a falling body.

Too, if the jumper isn't equipped with a supply of oxygen and he bails out far above the 15,000-foot level he'd be almost certain to lose consciousness in a comparatively slow parachute descent. Were he to take a free fall he could reach the 15,000-foot level rapidly. There additional supplies of oxygen are not needed to sustain consciousness.

A combat advantage Starnes later conceived after parachute troops became more commonly used was that of stratoheight jumpers taking free falls to near the earth. Planes would be most difficult to detect and the 'chutists would be virtually unsuspected until they were almost to the ground, giving the attack a much greater chance of success.

It all added up to a pretty convincing picture. He knew it would be fruitless to try spreading his theory before the public until someone had taken the first

Decompression chamber was used to accustom body to thin air of sub-stratosphere.



Doctors Carlson, Krasno and Ivy converse with Starnes during ascent. Mobile radio unit proved valuable aid in compiling accurate data for further study.

jump. That, he decided, must be his job.

It wasn't easy. A man doesn't just go up to the stratosphere and jump. It takes training, preparation and money. The war was pretty far from our door and the depression was with us when Starnes first started tugging at coat-tails and waiting in outer offices.

In the Spring of 1940, he wangled a three-hour session from Dr. Anton J. Carlson, then a professor of physiology at the University of Chicago. He could breathe, yell, see and think, when falling, Starnes told him.

"Incredible!" exclaimed Dr. Carlson. The learned physiologist began rooting about in scientific literature. A month later he told the jumper that he could locate no published data on the effect of falling on respiration, heart action, circulation and a few other physiological carryings-on. If Starnes wished, he (Dr. Carlson) would gladly assist in supervising the physiological phases of the undertaking.

They lined up a list of necessary equipment. It was a formidable looking list. They decided that all commercial agreements into which Starnes might enter must be in experimental channels, rather than profit-making ones. Starnes agreed to attend to all financial responsibilities and obligations.

Dr. A. C. Ivy, professor of physiology at the Northwestern University medical school, soon had a visitor, a fellow named Art Starnes. The visitor knew that Dr. Ivy and Dr. A. H. Andrews, Jr., of the Northwestern medical school and director of oxygen service of St. Luke's Hospital, Chicago, had a tank rigged up which could simulate atmospheric conditions of heights up to 43,000 feet. He outlined his project. Would Dr. Ivy assist? By the time Starnes finished his story he had another scientific adviser.

Doctors Carlson and Ivy started training their man as carefully as a manager drills a championship title contender, teaching him everything they could about the conditions he would face.

In the cylindrical tank, 48 inches in diameter and six feet long, Dr. Ivy, Dr. Louis R. Krasno of Northwestern and their assistants taught the scientific-minded parachute jumper as much as they could about air at different altitudes. They simulated oxygen conditions from the stratosphere down to earth, so that Starnes could become familiar with the varying air pressure through his oxygen mask. Oxygen from containers outside the tank was run into the jumper's mask through a tube, an automatic regulator assuring the evenness of the supply.

In the tank Starnes learned how to use his oxygen mask, to become familiar with the feel of a "drop" at various rates of speed. According to mathematical calculations, the maximum rate of a falling body is 180 m.p.h.—but it could also drop at 120 m.p.h., so they tried the whole

Astronomical telescope was installed in window to spot field before jump.

range and even faster speeds. In fact Starnes, before his famous jump, had theoretically been "taken up" to 43,000 feet and then "dropped" at the amazing speed of 790 m.p.h.!

Starnes already had learned to open his Eustachian tubes by lower jaw action. The movement is similar to forcing a yawn. He knew the importance of this latter practice because it prevents rupture of the ear drums, it being a means of opening the ears whenever a feeling of fullness is sensed there.

In the cold chamber at Armour Research Foundation, under Dr. T. C. Poulter, he became familiar with the operation of some of his equipment at extreme temperatures. Mask and goggles, for example, were tested against fogging. The experimenters theorized that the oval eye-piece of the goggles would fit so tightly that the lenses could not fog on the inside and the slipstream would keep moisture cleaned off the outside. (Later, in the actual jump, it was found that fogging occurred anyway.) Starnes tested his oxygen equipment at an ice cream plant.

At the Rubinkam Airport near Chicago a few practice jumps were tried from comparatively low altitudes, testing various pieces of equipment. Five jumps were made with scientific observations being taken before the first free-fall from the sub-stratosphere was undertaken. By then Starnes and his associates were confident that a high-altitude, delayed-opening parachute jump was possible just so the day was one of good visibility and the ground wind did not exceed 12 m.p.h. In fact they decided it was possible to train almost anyone to do this sort of thing, once fear had been overcome by showing that it could be done. The old theory about people losing consciousness in falling now is definitely disproved, providing that they have proper training.

Piece by piece the equipment was designed, manufactured or gathered from some scientific-minded source. It was no snap getting the necessary material lined up. Some came from organizations intrigued by the man's daring or interested in perfecting new products. Most came from Starnes' own funds or whatever he could line up in that direction. The equipment he carried in his sub-stratosphere jump brought his total weight to exactly 285¾ pounds.

The electrically heated suit, boots, gloves and helmet cost Starnes well over $200, but it was a sound investment since the temperature at the stratosphere height of 35,000 feet is negative 55°. That's cold! The suit protects the jumper in the plane and retains sufficient warmth to suffice him through the frigid early part of a stratosphere fall. It was tested in an ice cream company's cold room for three hours at temperatures as low as negative 50°.

For parachutes he bought a standard Irvin training outfit, consisting of a 28-foot back pack and a 24-foot chest pack. He froze the rip cord assemblies in dry ice at negative 65°, and when Starnes pulled the rip cord he found the outfit still opened.

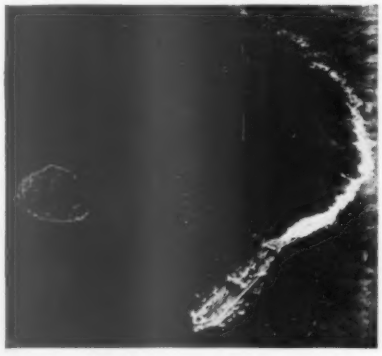
(*Continued on page 74*)

"Liberator" in Action

ENEMY planes, submarines or ships—the Consolidated *Liberators* serving the RAF Coastal Command take 'em as they come. And one *Liberator* had a very busy day recently when in the space of one hour it successfully encountered two Heinkels, a U-boat and a surface vessel over, under and on, respectively, the Bay of Biscay.

The following story of that action-packed 60 minutes, as told by the pilot in a British radio broadcast, adds another chapter to the long record of combat performance being compiled by American aircraft:

"Suddenly the rear gunner shouted: 'Jerry below.' I swung the *Liberator* round. There was a Heinkel float plane



The Nazi freighter appears deserted. Note the oil slick (left) from sinking U-boat.

right down near the surface of the sea. He looked as if he was trying to get away. We flew around, bringing all our guns to bear in turn, and we shot him up pretty thoroughly. One of our gunners gave a yell of excitement as he shot some pieces off the Heinkel's fuselage and his next burst set fire to one of its engines. The Heinkel never fired a shot and disappeared into a rain cloud as fast as he could. We were certain that his rear gunner had been hit and the pilot would have had to be lucky if he got home at all.

"Once again the sea and sky seemed empty and we were able to relax for a while and continue our patrol. I thought that we had had all our excitement for the day, when suddenly the rear gunner again shouted, this time: 'Big ship below.' I banked to have a look and there was a pretty sight indeed—not only the ship, but better still, beside her was a U-boat fully surfaced. Down I went and got the U-boat in our sights, raking her with gun fire. As we passed over her, I let go a stick of bombs, which fell very close to her. By the time we had turned a few seconds later, the submarine had gone and there was a patch of brown oil left behind.

"Then I decided to attack the ship, so we went over and dropped the rest of our bombs on her. We attacked her with everything we had and we could see

(*Continued on page* 81)

I LEARNED ABOUT FLYING FROM THAT!—NO. 34

by J. H. DRESSEL

When your engine misses in flight and you try to keep on going, your trouble is the "nut" holding the stick.

A STRING of hard luck is apt to make a person foolhardy—you get more disgusted as each link in such a chain of circumstances is forged and finally say to yourself, "To —— with it, I'll do it or bust."

I did just that some years ago, and although I did not quite "bust," the doing can be attributed to luck—fool's luck.

Just before Christmas in 1931, I decided to fly from Angola, Ind. to my home near St. Louis to spend the holidays. I got out to the airport for an early start since I was flying a well used OX-5 job and wanted as much daylight as I could manage for the trip. After warming the oil on a gasoline camp stove, I fired the engine up and made the take-off. Although it was one of those bleak gray days, the air was not too cold and the old "churn" was purring like a kitten.

I headed south as I wanted to transact some business in Muncie, Ind. and soon sighted Fort Wayne. Just as I was passing over the city, the engine started to cut up a little, and despite the fact that such an occurrence is not particularly unusual for an OX-5 engine, I decided to set down at the airport and check it over. Thus, the first link in the chain was forged, although I did not, of course, realize it at the time.

An inspection of the engine disclosed no cause for the trouble so I drained the jet wells and sold myself on the idea that a little water must have passed through the carburetor.

I climbed in and the gas man pulled her through—no result. We tried it again—still no luck. After half an hour of cranking, I was about ready to give up when another pilot offered to loan me a battery and booster coil. We hooked this to my magneto and managed to get the engine started. It "revved up" okay and sounded healthy again. I was dubious however, since I could not explain the hard starting, and I began to wonder if the miss had actually been due to water in the gas. With this thought in mind, I took off but soon felt reassured—the engine was running like a charm.

I had ducked my head below the cowling to indulge in a few puffs from a cigarette and meditate on how good it would be to spend Christmas at home when—"blooey"—the engine started to skip again.

I checked the terrain for a place to land and drew a blank—nothing but trees and hills. The tachometer dropped to between 1,000 and 1,100 r.p.m.'s, but as the trouble did not seem to get much worse, I decided to try and make it on in to Muncie. By the time I sighted the airport the tach' was showing less than 900, and I was losing altitude fast. After limping into a landing, I decided the trouble must be in the mag so the airport manager and I pulled it off and, as the field maintained no facilities for testing magnetos, I sent it in to town for an overhaul. The local electrician who was to do the job soon called to report that a new coil would be required. Since there were none available locally, I was forced to make the best of a bad situation and wait until the part could be obtained. After putting through several long-distance calls, I was able to locate a coil and found that, barring bad express con-

(*Continued on page* 101)

Now chief instructor in an Air Corps technical school engine department, the author (below with Stinson "105") uses his own experience as "what not to do."

A Million For Research

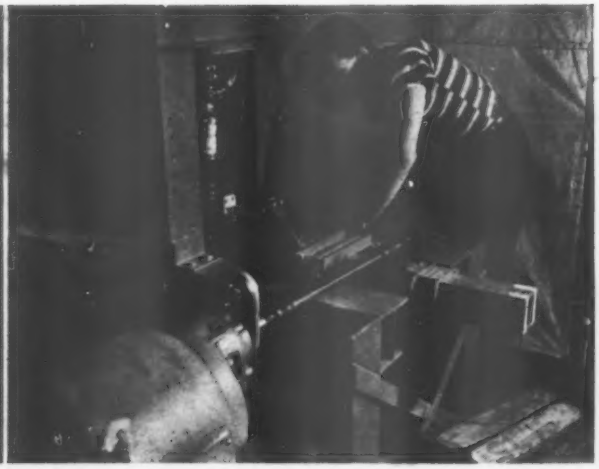
by EDWARD CHURCHILL

Application of practical science to aviation's problems of the future is basis of Lockheed's remarkable structures laboratory.

Suitable testing equipment and specimens often cannot be purchased. This fabricating shop creates what is needed.

Plastic windshields undergo severe test for stress and impact resistance before being specified for plane use.

Casting here is being given violent vibratory treatment while sustaining full load. Future aircraft will benefit.

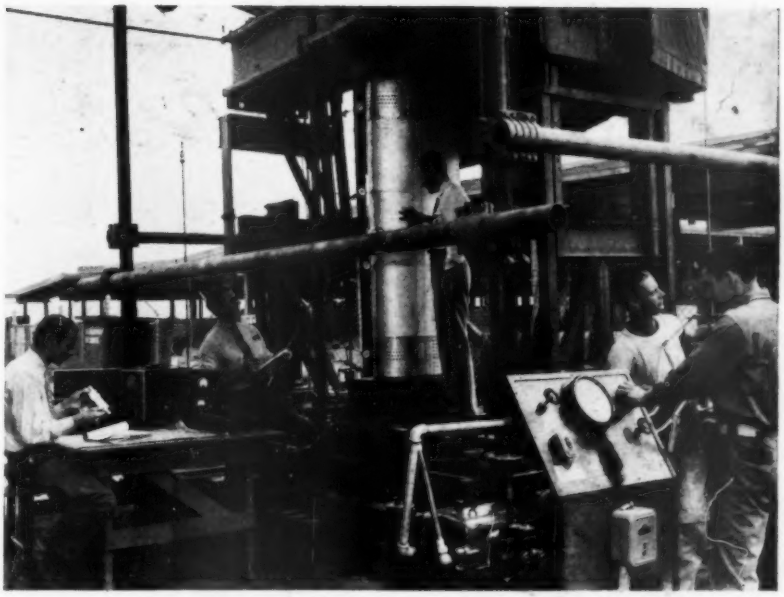


FOR the first time in aviation history a large aircraft manufacturing company is going "all out" for non-aerodynamic research in the hope of improving its own commercial and military product and helping the industry generally. At this writing, hundreds of thousands of dollars have been spent in plant and equipment which have been placed at the disposal of a staff of scientists and devoted, in the layman's language, to "taking the bugs out of airplanes."

How high can airplanes fly successfully and how much in the way of thin air can pilot and passengers stand in making such flights? Are plastics to be used only for relatively small parts, such as tabs and flaps, or will they be used extensively in highly stressed parts such as wings? Can large fuselages be moulded from plastics? What is the breaking point, under combined load and vibration, of a certain type and quality of aluminum alloy? How can shipments from metals manufacturers be standardized as to forming properties through the use of uniform processing? What are the effects of chemical treatments on aircraft metals? How much of a load will a certain casting carry?

These are just a few of the questions which are popping up daily as airplanes fly higher and faster, as mechanisms become more complicated, as aircraft become bigger and bigger. The Lockheed Aircraft Corporation has set out to answer them as fast as they present themselves. Compact, concise, planned for efficiency, a two-story building 140 by 100 feet has been stocked with every known testing device and more are being added daily, as they are developed. It is known as the Lockheed Structures Laboratory.

A quiet, slow-speaking, thin and dapper scientist, Dr. V. N. Krivobok, educated at Harvard University, has been placed in charge of the new enterprise. In talking with him and going through the building, one has the sensation of looking into tomorrow. Out of that structure will come developments and improvements which will give us the planes of the future.



Pressure test is given all aircraft parts to ascertain point of destruction.

There, I saw delicate instruments revealing the inner nature of sound recordings taken to trace vibration, enemy of aircraft; a huge mock-up of a four-motored airplane which contains every bit of the "plumbing" used in modern planes, with each piece of tubing, casting and all actuating hydraulic equipment in operation; a huge cylindrical chamber which simulates atmospheric flying conditions to 40,000 feet with a temperature reduction system which will lower the mercury inside to 70° below zero; photomicroscopes which "blow up" a picture of a tiny weld, perfect to the eye, to a point where any flaw can be detected instantly; vibrators which, working metal through thousands of vibrations a minute, do their work of destruction relentlessly, day after day; devices to test the largest landing gears, and countless other fascinating devices, each playing its part in this endless striving for perfection.

The significance of the laboratory lies in the fact that aviation has advanced to the point where it can afford non-aerodynamic research — a slow, expensive process which will not pay off immediately, but will mean great strides in years to come. Aviation, until now, has been unable to afford this vital need, which has proved itself in the automotive and other industries, working the wonders of the future with electricity, physics, chemistry, sound, light and the other elements and sciences available to them. Tomorrow's pilot, because of research, will know the exact limits of his airplane, his power plant, his passengers and himself.

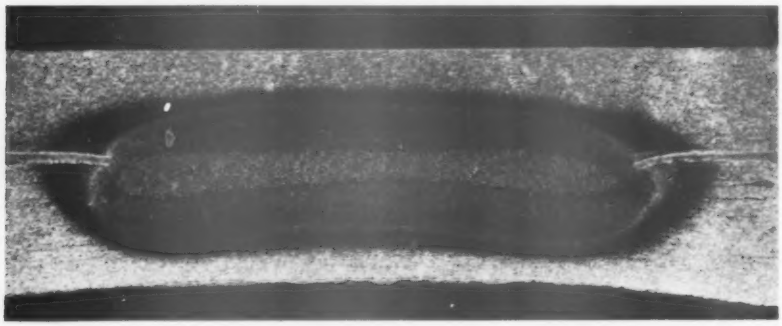
Dr. Krivobok is a practical scientist. He will not consider questions to which he does not know proved answers. And his background explains his attitude, for it, too, is practical. After his graduation from Harvard as an engineer he became a member of the faculty of the Carnegie

Bent aircraft parts are vibrated until breaking point is determined. Individual clocks note exact time of failure.

Equipment used to control cabin pressure is tested under simulated high altitude flying conditions in air chamber.

Metallurgical examination provides data on aircraft metals before and after fabrication; aids utilization of metal's full strength.

Special apparatus used in flight tests must be carefully calibrated on a machine such as this.



Spot welding process joins dural sheets under high pressure electrical current.

Salt spray test shows in a few days probable corrosion over period of years.

Institute of Technology, where he remained for 17 years, leaving because he had always liked aviation and because he had long been aware of its future possibilities. During many of those years, he also served as director of research for the Allegheny-Ludlum Steel Corporation.

The Lockheed Structures Laboratory began having growing pains last October, when Hall L. Hibbard, vice president and chief engineer of Lockheed, was given the go-ahead by Robert E. Gross, Lockheed president. Plans for a modern wind tunnel had just been completed and the work on the tunnel was well under way, under the direction of C. L. ("Kelly") Johnson, Hibbard's right hand man in charge of aerodynamics, preliminary design and flight testing. The building-up of the laboratory was visualized as a logical parallel to the increase in aerodynamic research, and the two buildings, which are side by side, were completed almost at the same time.

The term "structures research" was adopted to distinguish this group from the existing aerodynamics research group. Actually the term "structures" is used in a very broad sense to include practically all kinds of non-aerodynamic research, such as production, mechanical, chemical and so on. The newly-created structures research section was placed under the chief structures engineer, F. R. Shanley, who also is in charge of the stress analysis activities in the engineering department. Dr. Krivobok reported in January, 1941, to take over the immediate direction of the new laboratory setup under Shanley.

The organization of the laboratory staff is based on the types of work undertaken. There are four divisions: mechanical research, headed by B. A. Rose; structures research, in charge of C. J. Henkel; production research, headed by Mrs. M. M. Rockwell; and physical and chemical

research, which is in charge of William F. Hamilton. The laboratory machine shop and other service activities common to all groups are supervised by E. J. Miller. In all, there are 250 employees in the four divisions, and the number is increasing steadily.

The laboratory is actively working with the medical research department in the testing of pilots—that is, studying the effects of high altitudes and speed flying on them. Milo Burcham, who has been testing the famous fast interceptor P-38, has been the object of intensive study. ["Testing the P-38," FLYING, March, 1942. —Ed.] The laboratory's "flying chamber," previously mentioned, will be used for further and more exhaustive tests.

In explaining the operation of the four divisions of the laboratory, Dr. Krivobok declares that mechanical research covers everything "having to do with the present or future models of the company as far as mechanics are concerned," citing air conditioning, air pressurizing of cabins for high altitude flying, operation of hydraulic systems, landing gear and other functional components, including instruments. A division has been set up to study the instruments exclusively.

"To illustrate," Dr. Krivobok declares, "there's the combined problem of cold and reduced pressure at high altitudes, say 25,000 feet. Heating of cabins and maintenance of normal air pressure must be accomplished. Available machinery is too bulky and too heavy. So we must develop new means which will not only do what we want them to do but be extremely light in weight."

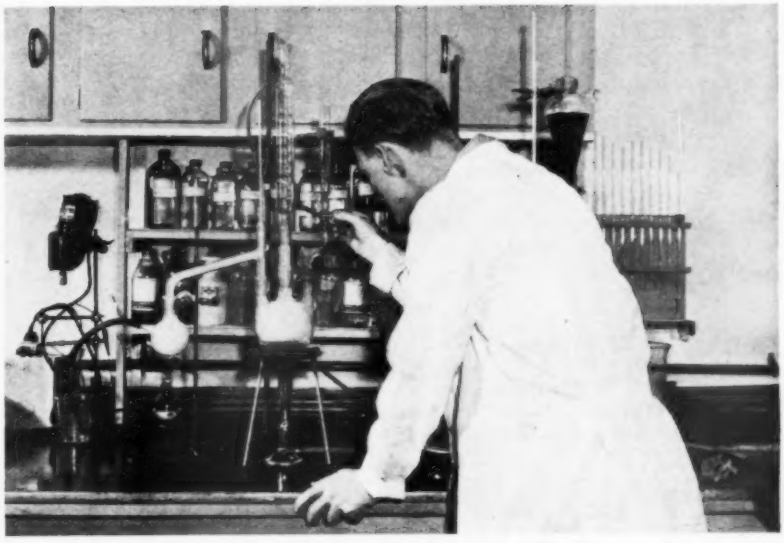
The work of production and structural research is often supplementary. Much of the work has to do not only with new type structures or new kinds of metal or other material, but with the actual assembling and testing of production models. Thus, the efforts are devoted to the development of new types of construction, the joining of parts, the forming of parts, application of recently available materials and many other problems.

In the case of part forming, variations in the formed product must be eliminated. Stamping or forming machines, bending, shaping and forcing metal into complex parts, do the job accurately. But when pressure is removed the processed metal has a tendency to spring back. A slight springing results in a poor fit. Therefore, the amount of actual spring must be calculated in order to achieve absolute precision.

Dr. Krivobok, in elaborating on the need for this type of research, pointed to the work in developing the exploding rivet, pioneered by a powder company.

"One of the many production problems—and one of the meanest—is the blind rivet," he declared. "Many different methods of solving it have been tried and several are being tested in our laboratory. For instance, in one promising type the end of the rivet is filled with an explosive mixture; the rivet is inserted from the outside and a heating element is applied to the head. The charge explodes, causing the inserted end to mushroom. The laboratory must decide which is the most practical type."

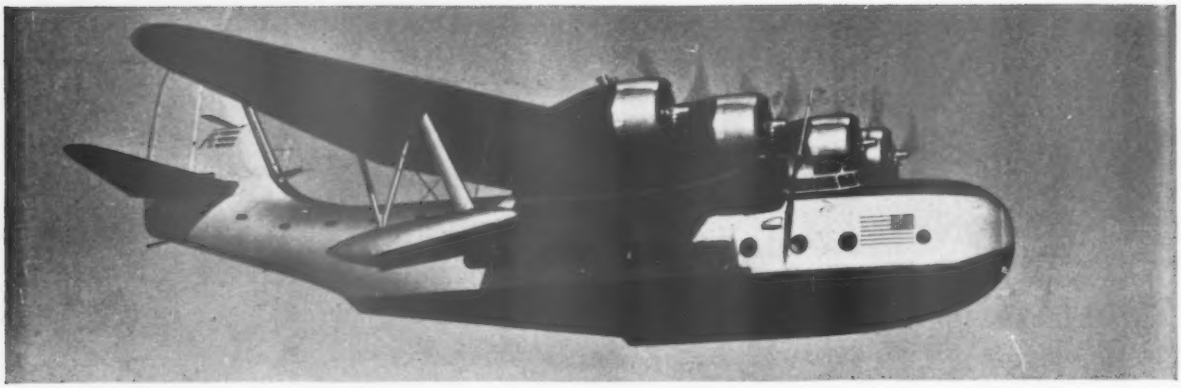
(*Continued on page 78*)



Finishing processes must be adaptable to wide variety of climatic conditions.

Glass blower's art is applied to fabricating unusual parts for experimentation.

Aluminum parts are fabricated on wooden blocks. Here engineer checks accuracy.



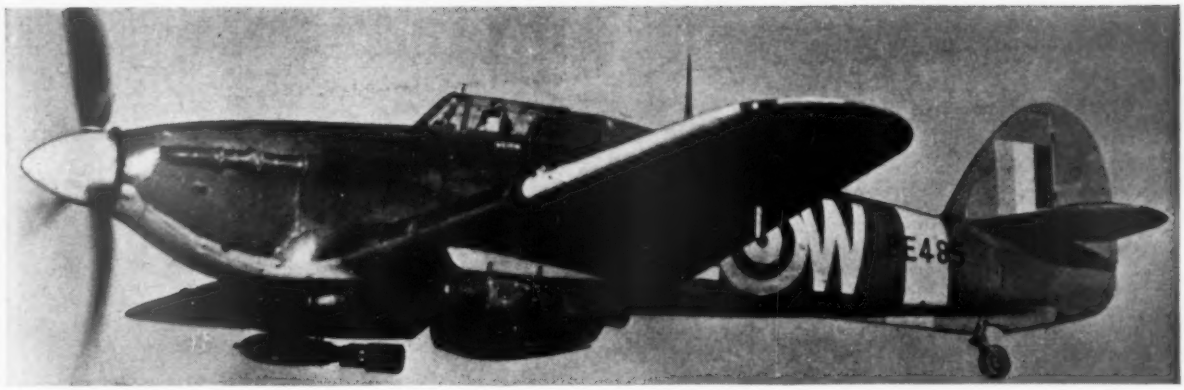
Vought-Sikorsky "Excalibur" for American Export Airlines' proposed transatlantic service has 235 m.p.h. top speed and 175 m.p.h. cruising speed with full load. Maximum range may exceed 6,000 miles. "Wasps" twin-row engines deliver 4,800 h.p.

HAVE YOU SEEN?

Originally built for Siam, this North American P-64 now is an Army advanced trainer. Engine is a Wright "Cyclone."

Handley Page slotted ailerons give sensitive control to new lightplane made by California Aircraft Corporation.

Returning from a patrol somewhere in the Pacific, this Douglas "Devastator" (SBD) circles its carrier before landing. Horizontal red and white bars on rudder are a new marking system just adopted by the Navy for all its combat planes.



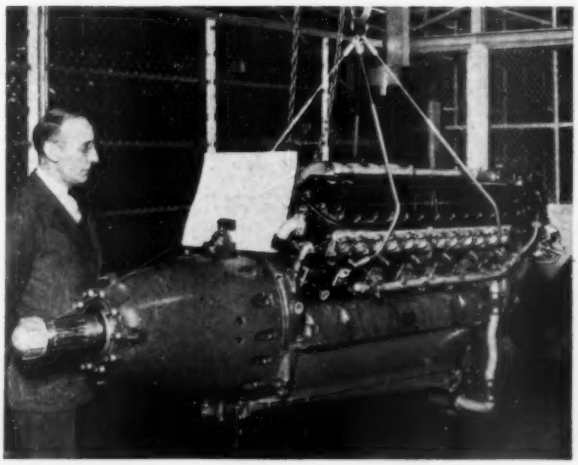
With bombs added to armament, Hawker "Hurricane" becomes formidable threat to shipping and ground forces. Low level attacks are made, as delayed-action fuse permits plane to get clear. Bombs (note in racks) do not alter performance.

His landing gear stuck, Naval cadet (top) skims water, (center) pancakes down and (above) awaits his rescuers.

Lockheed "Lodestar" is flying office for President Vargas of Brazil. Army markings were removed when plane left U. S.

Southern Aircraft Corporation's BM-10C trainer cruises at 105 m.p.h., has top speed of 123 m.p.h. with 125-h.p. Continental engine. Range is 355 miles, payload 720 lbs.

Battle-scarred Allison engine, shot down in RAF plane during Libya campaign, is exhibited to factory workers at Allison plant, Indianapolis. Note four bullet holes.



AIRCRAFT OWNERS AND PILOTS ASSOCIATION

AOPA NEWS

The Aircraft Owners and Pilots Association, with Service Headquarters in the Michigan Square Building, Chicago, Ill., is a non-profit organization formed and composed of non-scheduled aircraft pilots and/or owners exclusively. *The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is devoted to news of importance to AOPA members and is of a non-confidential nature.**

Regulations Sabotage Defense?

RECENTLY it has been reported to AOPA that 65 per cent of the applicants taking the new multiple-choice CAA exams for mechanics licenses *failed*. This report applied to a large area and included several large training schools. Previous to the inauguration of the new examinations a very large percentage of the graduates (given the same course of study) were passed.

This again raises the question of CAR changes during the war period. AOPA has advocated that *no* changes be made in the CAR for the duration except those absolutely essential to national defense. Recent developments now indicate that this would have been a wise policy.

The multiple-choice questions and answers were intended to raise the standards of mechanics. A result of the large number of failures is that schools will change their curriculums to include *more theory* and less shop work! This in spite of the fact that the cry has been for the opposite—for *more practical* and less theoretical knowledge.

RAF Cadets Complain

British pilot cadets have also complained that the American standards of examination (in this case military pilot examintions) are "far too high" for wartime. AOPA has learned that over half of the English youths sent to the United States for pilot training have been washed out. Most of them have returned to England and will undergo training as observers and gunners.

Black Hawk Unit

Newest of AOPA Units is the Black Hawk Unit located at the Moline Airport, Moline, Ill. Pictured on page 46 are 32 of the 43 original members. Among the worthwhile projects undertaken by this energetic group is the preparation of a map showing all of the restricted areas within normal flying radius of the unit. A committee has been appointed whose duty it is to keep the map up-to-date and all members informed as to changes. The Black Hawk Unit has set a quota of 100 members for the year ahead and we bet they make good. There are now almost 200 AOPA Units.

Officers and members of the new Unit are as follows: Wilbur Stephenson, chairman; Claud Smith, vice chairman; Harry Bonner, secretary-treasurer; members: W. Maze, V. Schafer, H. Brandenburg, B. Bredt, S. Wiggins, C. Carter, H. Olson, S. Sommers, H. Lindbloom, W. Rousey, W. Yerger, K. Lee, F. Delaney, F. Adams, E. Chaney, D. Erickson, Mrs. D. Erickson, P. Willet, May Ball, P. Harlow, J. Lawless, B. Freed, G. Mosenfelder, F. Cramer, H. Neilsen, C. Shoemaker, R. Lee, T. Smith, W. Ziegler. Not pictured are B. Gill, R. Brown, W. Breeze, E. Erickson, E. Priebe, C. Watters, W. Towner, H. Rasmussen, L. Weber, P. Tied, C. Peterson.

Boys in the Service

The Executive Secretary of AOPA has requested through this column that all registered AOPA pilots who are now with the armed services make this fact known to the Washington AOPA Office, Room 605, Carpenters Building, 103 "K" Street N.W., Washington, D.C. A special roster is being prepared and all members who know of fellow AOPA pilots in the service are requested to report the fact to this office.

Shining Faces

Pictured herewith are a part of the some 80 AOPA members who attended last month's Metropolitan Oakland Unit meeting. The picture was taken by Carl Bigelow who, according to Ed Landell, secretary, "is a very enthusiastic new member who already has brought in enough new members to put him in the booster member class." At this meeting the Civil Air Patrol was discussed and applications were filled out. A report on gliding and soaring was given by Walter Morrison, augmented by moving pictures which brought forth a move to form a gliding club during the period when power aircraft are grounded on the west coast. It was later learned that the Army considers gliders as aircraft but further inquiry is being made into this problem.

AOPA in Washington

An AOPA office has been opened in Washington. J. B. Hartranft, Jr., executive secretary, in reporting this new development said: "The Washington work of the AOPA has increased to such tremendous proportions due to war legislation that a regular office was considered necessary for the duration." Membership work will continue to be handled from Chicago but projects and some service work will be transferred to Washington because of the need for close liaison with various Governmental agencies. Washington address: Carpenters Building, 1003 "K" Street N.W.

Change of Address

The change of address department has never worked harder than at present. Several hundred changes of address are reported every week. Many more AOPA members move but fail to advise us of their new address. Result: no mail. We urgently request that you advise us immediately of any change of address. In writing, please give *old* address as well

(*Continued on page* 96)

* The views and statements of opinion contained in this column are those of the Aircraft Owners and Pilots Association and not necessarily those of FLYING. This column is edited by the staff of AOPA for its members and other interested parties. Special releases of a more confidential nature are additionally sent each month to all registered members.

Black Hawk Unit of Moline, Ill., is the most recent AOPA group to organize. Above are 32 of its original members. Metropolitan Oakland, Cal., unit below.

THE ALL-AMERICAN AIRPLANE FOR ALL AMERICA

The *Three-Place* PIPER

SUPER CRUISER

LOWEST-PRICED 3-PLACE PLANE IN AMERICA!

100-HORSEPOWER LYCOMING DIRECT-DRIVE ENGINE!

CRUISING SPEED OVER 100 MILES PER HOUR!

MORE EFFICIENT STREAMLINED LANDING GEAR!

Here's the plane for '42 . . . geared to the wartime economy of the nation! The new Piper Super Cruiser combines in one ship a multi-purpose usefulness unequalled in any plane within hundreds of dollars of the Super Cruiser's low price. Flight schools, CPT contractors and flying service operators will find the Piper Super Cruiser an efficient and economical primary pilot trainer. If blind flying equipment is installed it becomes an excellent ship for instrument instruction. In the CPT cross-country course it can be used for both night flying and solo cross-country phases. And its 25-gallon gas capacity, speed and payload ideally adapt it to Civil Air Patrol flying. The Piper Super Cruiser is engineered and built to serve every flight requirement . . . the All-American airplane for *all* America.

FREE CATALOG showing all the Piper planes may be obtained from your Piper Dealer. Or, if you wish, we will gladly mail you one of these handsome, deluxe catalogs which portray all the new Piper ships in full natural color, providing you enclose 10c in stamps or coin for postage-handling. Piper Aircraft Corporation, Department PA42, Lock Haven, Pennsylvania, U.S.A.

LET'S GO! U.S.A. KEEP 'EM FLYING!

PIPER POINTS THE WAY TO WINGS FOR ALL AMERICA

The New Strategy of War

(*Continued from page 25*)

fault here lies not with the battleship but with the gentleman directing its war activities.

A turning point in British and American naval thinking must have been reached when Japanese torpedo and bombing planes blasted and sank the brand new 35,000-ton battleship *Prince of Wales* and the 25-year-old 32,000-ton battle cruiser *Repulse* off the Eastern Malayan Coast on December 9. These mastadons of the sea had the maximum of antiaircraft protection and were accompanied by a screen of destroyers. All they lacked was the presence of available air support.

The *Prince of Wales*, completed only last spring, was the latest thing in English battleships with 10 14-inch guns, a 16-inch armor belt at the waterline, six inches of deck armor, and was divided into innumerable watertight compartments to absorb underwater damage from torpedoes (the armor belt does not extend far below the waterline). The battle cruiser *Repulse* (a battle cruiser is a fast battleship, with less armor protection) had been modernized to resist torpedo hits.

Japanese bombers and torpedo planes, estimated at 18 of the former, 50 of the latter, appeared in relays. The battle raged for an hour and a half, bombs and torpedoes against antiaircraft fire from the big warships and their accompanying destroyers. The Japs won the battle. First the *Repulse*, apparently hit by only two torpedoes, then the *Prince of Wales*, heeled over and went down, with a loss of nearly 600 officers and men. The Japs had proven again that airplanes can sink battleships—just as General Billy said they could 20 years ago—and that warships with antiaircraft artillery alone are no match for determined pilots flying torpedo planes. Only the most experienced and salt-encrusted admirals ever thought they were, any time during this past 15 years.

The British admiral in command of this fleet that steamed straight to Davy Jones' locker was not an airman, but a seaman. British fighter planes, from shore bases or from a carrier, if available, would have changed the outcome considerably. They might have beaten off the attack and saved the warships. But the admiral didn't consider it necessary to call them until his ships were actually attacked—although he knew that his squadron had been sighted and evidently reported by a Japanese reconnaissance plane. When finally attacked, he called for air support; the planes arrived after the ships went down.

The *Prince of Wales* had never fired one of its expensive 14-inch guns at an enemy battleship. Its one useful contribution to the war effort of Britain has been to serve as an unmistakable warning that warships without adequate air protection against enemy air forces are more than likely to become merely helpless targets. Perhaps for that contribution, if the lesson has been learned, the *Prince of Wales* has been worth her cost.

Most noticeable in this war is the demonstrated fact that generals and admirals, trained only for land or sea warfare, take little notice of air power until it is actually upon them and their forces. As to Pearl Harbor, the possibility of carrier-based bombers and torpedo planes attacking warships in harbor was clearly foreshadowed by the British navy's successful air attack on the Italian battleships in Taranto Harbor. This offered proof that the most dangerous place for a warship to be was at anchor, with its crew not on the alert and with no air patrols ranging the sea to detect the approach of enemy air forces. These Pearl Harbor commanders had been warned by the War and Navy Departments that war was imminent, and it would seem only common sense for them to be on the alert. Yet they weren't—and even the listening posts were not manned. A private happened to be listening, for practice, heard the planes, reported to his superior, who said they were American planes! The Navy even sank a Jap submarine in restricted Hawaiian waters but failed to report it in time. An air attack was the last thing expected because senior non-air officers in our forces think of the air last, not first. Until they think in terms of air power and its effect upon land and sea forces, we will fight at a disadvantage. The Japs have demonstrated that they think this way; our commanders have not yet done so.

"If you think I planned it this way, lady, you're nuts!"

However, it would be superficial thinking to relegate too much importance to air power. Air power has not yet won any war. Probably it never will do so alone, against an enemy capable of resistance on the sea and the land, as well as in the air. The three forces are needed: land, sea and air. Whether they are coequal or not is an academic question. That they must work together is axiomatic. And each must understand the problems of the other.

Our greatest problem in the Pacific is one of distance, of geography. Suppose we want a huge air force in the Netherlands Indies, or in Australia or in Russian territory around Vladivostok. How does it get there? The long range bombers may fly there. But all the rest that makes up an air force must go by sea, on boats. There is no other way. You can't simply fly an air force, with its equipment and bombs and fuel and ground personnel, ten thousand miles and then go into action. Thus the first controlling factor in all of our western Pacific operations is that everything we dispatch to the war zone must go by sea. This also is true of Japan in its drive on Singapore and the Netherlands Indies and eventually Australia.

But the Japs can work on inner supply lines, their naval vessels and transports and supply ships always within range of the Jap land-based air forces, all along the China coast. Our own fleet and the huge convoys that will be required to transport our land and air forces and their thousands of tons of supplies will be without protective air power, other than carrier-based, until they come within range of the Netherlands Indies or Australia. Air protection available then will be only what already is based there by the British and the Dutch. It cannot be augmented, or kept even to its initial strength, except by replacements from the U.S. or Britain. And getting it there is a Navy task. Without the Navy there will be no air force of ours in the Western Pacific. Thus when we say that warships are useless unless they have air support, when they encounter enemy aviation, we also must remind ourselves that our air force 10,000 miles from our shores will be non-existent until the Navy gets it there. They are, in short, inter-dependent forces, and it is useless to argue which is the more important. Neither can work effectively, or at all, without the other. Can we, then, have done with air-sea-land arguments, and declare once and for all that all are needed? To protect air and naval bases soldiers are required; air forces and navies do not occupy territory.

A generally-held civilian opinion has been that in a war with Japan we would send our Fleet across the Pacific, fight the Jap fleet and undoubtedly smash it. Our battleships, we have been told by many competent naval commentators and

(*Continued on page 64*)

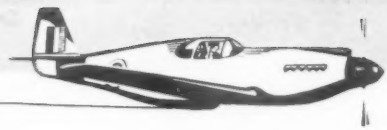
"INTO THE SUN" by John Hammer

WITH PLENTY TO SPARE . . . Hurtling into the upper air with the thrusting force of 2,000-h.p. turbo-supercharged engines, Republic *P-47* Thunderbolts, fiercest fighting planes of the Army Air Forces, will get there "fustest" with the most striking power for deadly interceptor action. Republic Aviation Corporation, Farmingdale, Long Island, N. Y.

REPUBLIC AVIATION

REPUBLIC AVIATION

IN R.A.F. SERVICE



Mustangs

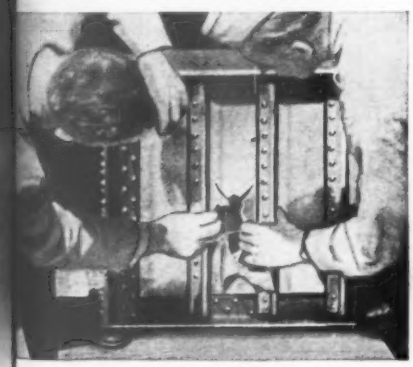
ARE "BUCKING" INTO THE JOB OF DEFENDING BRITAIN

NORTH AMERICAN AVIATION, INC.

Dallas Inglewood, Calif. Kansas City

bot Draughtsmen were Martin's solution en expansion made a shortage of engineers in- itable. Now Martin's giant photo-layout method roduces drawings in full scale directly on sheet tal, eliminates layout time, makes available ndreds of engineers for more important work.

stic Pioneering Paid Off—when alumi- m became critically scarce in 1940. Winner of the 40-41 Modern Plastics Award, Martin now uses stics in place of aluminum for 400 different air- ft parts. Pictured is the business end of a Martin 6—made of tough, light-weight plastic.



1940 General Arnold "Must"—self-seal- fuel tanks. Martin—with the Mareng self-sealing k—was first to answer. Riddled by machine gun , the Mareng tank remains leak-proof—is now ndard equipment on many American warplanes.

n Fingers Supplant Hands in sorting the ousands of rivets swept up from Martin floors h day. This rivet sorter is just one of scores of nor labor-saving devices developed by Martin— save precious man hours that will help reduce duration of war.

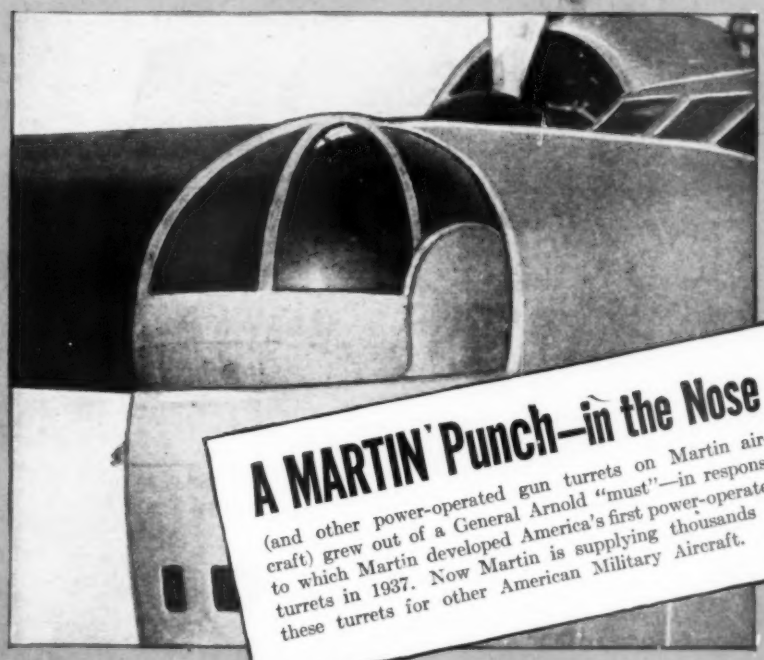
MARTIN Developments

used throughout Industry

pay War Dividends

MADE available to all industry, many Martin developments now are speeding America's war output, improving America's military materiel. A few of these developments are pictured here. Some are still cloaked in secrecy. Hundreds of others, individually minor but collectively important, are making a major contribution to America's war effort. Meanwhile, throughout the Martin organization, more developments are afoot—to add new might to tomorrow's aircraft, new efficiency to tomorrow's production methods.

THE GLENN L. MARTIN CO., BALTIMORE, MD., U. S. A.



A MARTIN Punch—in the Nose

(and other power-operated gun turrets on Martin aircraft) grew out of a General Arnold "must"—in response to which Martin developed America's first power-operated turrets in 1937. Now Martin is supplying thousands of these turrets for other American Military Aircraft.

Martin AIRCRAFT

Builders of Dependable Aircraft Since 1909

Military Mission... KOLLSMAN'S LOCKHEED

LABORATORY TESTS ARMY-NAVY AIRCRAFT INSTRUMENTS

Every day, pilots of the United States and Allied forces are learning new lessons in combat flying.

As a result, suggestions for improving instruments constantly come from men on the fighting fronts.

And constantly, Kollsman is faced with the problem of exploring the worth of new ideas. Improvements are made by master craftsmen. But no matter how expert the work in the shop, the instruments must be tested and proved under actual flight conditions.

This is the job of Kollsman's Lockheed Flying Laboratory . . . a job that saves the military forces precious time . . . and delivers to them instruments ever approaching perfection . . .

To keep 'em flying . . . to keep 'em fighting!

KOLLSMAN
AIRCRAFT INSTRUMENTS
Division of
SQUARE D COMPANY
ELMHURST, NEW YORK • GLENDALE, CALIFORNIA
DETROIT, MICHIGAN

THE WORLD'S *Deadliest* DIVE BOMBER

FIRST
Since the Birth of Aviation

1928 · First United States Navy Airplane built specifically for dive bombing tactics and carrier operation. Two fixed guns in upper panel and a rear swiveling gun completed the armament.

1933 · Further streamlined, using a twin-row radial engine for higher performance, the now famous Curtiss Helldiver was in use by both the United States Navy and Marines.

1937 · High performance dive bomber with heavy defensive armament and completely retractable landing gear. Many squadrons of the Curtiss SBC-3 type operated from carriers of the United States Fleet.

1939 · The SBC-4, powered with a Wright Cyclone, superseded the earlier type and excelled its performance. Planes of this model were still being delivered to carrier-based Navy units and Reserve ground bases in 1940.

Send for YOUR copy of this fascinating 64-page history of aviation by Assen Jordanoff, author of "Your Wings", with illustrations of current fighting types. Send 10¢ to cover mailing cost: Airplane Division, Curtiss-Wright Corp., Buffalo, New York.

...MODERN DESCENDANT OF THE WORLD'S *first*

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(*Continued from page 58*)

writers, are more heavily armored, carry more gun-power, but are slower than Jap battleships. In a stand-up fight we should win, they say. But to fight at all we must get there—and the effective cruising range of a navy is 2,500 miles; it cannot safely move further than 2,500 miles from its nearest base unless it carries with it a vulnerable train of supply ships, difficult to protect.

From San Francisco to Manila via Honolulu, Wake and Guam is nearly 7,000 miles. But Wake and Guam have been captured, Manila is in enemy hands; the direct route is closed. Our fleet and our convoys of supply ships must take the long way around by Samoa, skirt far south of the Jap Caroline and Marshall Islands, now used as Jap submarine and air bases. We are, in effect, 10,000 miles by sea from the battlefront of the Netherlands Indies, Singapore and Australia.

Japan is only 1,200 miles from Manila, Formosa only 435. From Indo-China and Thailand the Japs moved heavy forces into Malaya, then Singapore itself and were on the way to Java. Almost within their grasp is the oil, tin and rubber they need for a long war.

It is land-based Japanese air power that must give the Jap navy the air advantage in any engagement, even if the fleets of Japan and the United Nations were equal in numbers of ships, which apparently they are not. The loss of two American and two British capital ships has put us on the defensive. We must hold our Fleet as a barrier against a main Jap fleet movement to Australia, if the Japanese drive finally wins them Java. Our Navy evidently must stay within the protection range of American, British and Dutch bombers; as the Jap navy must cling to the protection of its own air forces. Thus early has air power limited and prescribed the action of navies.

Any consideration of direct air attack on Japan from Russian bases must wait upon the outcome of this year of war. To build, supply and maintain air bases for a war of bombardment against Japan means going around the northern route—Alaska, Dutch Harbor, the Aleutians, Russia. Getting the air force there is a Navy task. Here, as in the south, the Air Forces must depend on the Navy. And both must depend upon Russia's future policy toward Japan.

Looking at the big picture of the war, we see that the British in the Middle East have a sea problem almost as difficult as ours in the Pacific. If the Germans stabilize the Russian front—and fortunately there seems nothing as unstabilizable as that Russian Army!—the Germans undoubtedly will try to drive through Turkey to the oil of Iraq and Iran, and with heavy land-based air forces drive the British from the eastern Mediterranean. If they succeed, the Germans will accomplish what the Japs are striving to accomplish—to seize the raw materials with which war is waged. The basic problem in both war theaters is the same: the problem of a long supply line, for from England it is 10,000 miles around Africa to Suez. Thus from the United Nations' viewpoint final victory must depend upon their ability to keep an unending supply of shipping moving from home ports and arriving safely in the war zone. The war can be won by ships, protected by airplanes or lost for the lack of them.

As we and the British are so dependent upon ships, it is not too comforting to reflect upon capital ship losses in this war, a claimed but as yet unverified 14 so far for all nations. Nine are admitted to be sunk, many others damaged. We have lost the *Arizona*, and the *Oklahoma* is capsized, may be floated later—much later. The British have lost two battle cruisers, one new and two old battleships. The Germans have lost the *Bismarck* and a pocket battleship (really a heavy cruiser); the Italians lost two or perhaps three battleships. Japan has lost the *Haruna*, France the *Bretagne*. Britain has lost three aircraft carriers. Of the sinking of the carrier *Ark Royal*, The Aeroplane of London says: "Until a single torpedo from a submarine ended her career, she had seemed to bear a charmed life. The unhappy thought is that a single torpedo sank her. We have been led to believe that a big ship could survive the damage which one or two torpedoes might cause, and we find ourselves perturbed at this circumstantial evidence of underwater vulnerability . . . No critic has ever suggested that, as a ship, an aircraft carrier was likely to be more vulnerable to torpedo attack than other big ships, properly equipped to localize underwater damage."

Possibly more than one torpedo hit the *Ark Royal*. But the thought to engage naval minds is that torpedoes, whether from submarines or airplanes, can sink capital ships. Every type of ship has proven itself vulnerable to torpedo and also bomb attack. The carrier *Illustrious*, for example, was put completely out of action as a carrier by one 1,100-pound bomb that went down the elevator of its flight deck. The carrier, indeed, is the most vulnerable of all warships, for one or two direct bomb hits on its flight deck can end its use as a carrier, even though the ship may steam safely away, as the *Illustrious* did.

My thought about this war, for what it may be worth, is simply this: The torpedo so far has proven itself the most destructive weapon against ships. Therefore provide the quickest, cheapest means for delivering that torpedo—or bomb, for the bomb also has proven effective. In the Navy, that means airplane carriers. It need not mean huge craft with 70 airplanes aboard—all of which may be put out of action in a few moments by one or two lucky torpedo or bomb hits on the carrier. It should mean as many aircraft carriers, of all sorts and sizes, as we can construct. They may be converted passenger or cargo ships, or fast and small carriers of new design. They might even be battleships now under con-

(*Continued on page 68*)

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The reasons are many. The Franklin 80 with Electric Starter and Generator has already established for itself a reputation for tireless stamina. The kind of performance *necessary* for Civil Air Patrol duty.

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Franklin's booming reputation for *more* hours in the air, *fewer* under the mechanic's hand, is the main reason for the pyramiding demand for Franklin engines. For Defense duty, for Civil Air Patrol, for Civilian Pilot training, it's Franklin First for Forty-two.

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Produces a greater flow of air to reduce operating temperatures in cylinder heads and barrels.

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CITY

(*Continued from page* 64)

struction, with their guns and top works done away with and a flight deck provided instead of them.

What use were the huge guns on the *Prince of Wales* and the *Repulse*? What use were the guns on the *Haruna*? Wouldn't 24 fighter planes have been more useful in shooting down attacking airplanes? And was the British carrier *Illustrious*, put out of action by one bomb, as useful as two small carriers would have been, if one only had been hit?

We must start to think in smaller units, in hitting power, in mobility. We must build ships that we expect to lose, if badly hit; we must build ships that we can afford to lose because we may quickly replace them. We must stop thinking in terms of 45,000-ton battleships, which are all very well but they take too long to build—and require air protection when they do go into action.

Let the naval and air minds get together and figure out how best and how quickly they can work together. Neither air power nor sea power can win this war alone. Together, and with our American production ingenuity, there is no possibility that they can fail.

The command of the sea now rests only partly on surface warships. Alone, unsupported by air power, they cannot prevail against an enemy with strong air forces. Navies today are in a transitional period, moving from the surface of the sea to the air above it. Their eventual role may be chiefly to insure that land-based air power is delivered, with all its supplies, to distant theaters of war. For in the final analysis I think it will be clear that air power based on a ship, on any kind of ship, rests upon an uncertain foundation. The air power of the future will be based upon land. Air forces will use navies to help them get there. At least, so it appears to me.

END

We Must 'Freeze' . . .

(*Continued from page* 18)

on a production basis than any other machine of similar complexity—provided only that fixed basic specifications be retained long enough to make it worth while actually to tool a plant for mass output.

Making a distinction between standardization of basic design and tight freezing to an unreasonable degree, the Truman committee thus stated the case in a section of its interim report bearing on aviation:

"The service agencies have a policy against standardization of aircraft because they say that standardization necessarily means 'freezing' design which automatically results in inferior aircraft.

"A recapitulation of the general evaluation of the types of airplanes manufactured in this country will indicate that the only field in which we have anything like a general superiority is in the production of bombers and that is the only field in which we have anything approaching standardization. If standardization necessarily means a loss of quality, then the performance figures are wrong.

"This objection, often raised, that standardization halts development, has been met with the suggestion that research and development could just as well be stimulated by a bonus or award system for new developments. Thus, we could acquire the benefits of standardization and retain the stimulus for technical advancements.

"Standardization, as followed abroad and in this country in the heavy bomber field, in the sense of limiting the designs of a given type to the best one or two or three available, and having those produced identically by all the companies, seems unquestionably desirable. It is significant that Britain and Germany have only two or three types of fighters, as against 10 or more produced by 10 companies in this country. It is significant, also, that here in the field in which our greatest job lay (heavy bombers) we have stabilized our production on two designs to be manufactured by several companies. We haven't yet, however, frozen the designs for any period.

"In the experience abroad and in our experience with heavy bombers it has not been demonstrated that such standardization means either freezing of design or inferior aircraft. By reputation our heavy bombers are the best in the world, while we have yet to get into production on a fighter which is rated as superior to the *Spitfire* or the Messerschmitt.

"Standardization, once achieved, has many obvious advantages. It should be carried out not only in the production of types but in the hardware, fittings, equipment etc., in all planes for our own use and for the use of our allies. Production, over-all quality and performance would be increased. Maintenance and supply problems would be greatly decreased.

"So far we have accomplished little, except in heavy bombers, toward any real standardization. The only real effort which is apparent on the part of the service agencies and many manufacturers is toward the standardization of hardware, fittings etc.

"Some manufacturers have gone so far as to say that they couldn't manufacture the designs of another company and that other companies couldn't manufacture their designs. Perhaps they are right. But the fact remains that it is being done here and abroad. In the meantime, we continue to purchase 10 or more pursuit types from 10 companies, eight or more dive bomber types from eight companies, etc. It is needless to say that most of the types are generally considered to be mediocre, at least.

"In addition to the situation outlined above, we find that we are buying as many as four or five types from one manufacturer, which are often built side by side. Most production experience seems to indicate that the most efficient operation is that which is confined to the fewest types of construction."

On the matter of pursuits, the Bell P-39 is being produced now at a satisfactory rate, the committee found, and is generally considered the only American-built pursuit plane presently in production that is satisfactory to the British and to our own Air Forces. Of two other principal types on which testimony was given by Lieut. Gen. Henry H. Arnold, chief of the Army Air Forces, neither is a completely proved model and one will not be in quantity production for months to come. The Army's heaviest reliance has been and still is on a pursuit type which has not been found satisfactory by either the British or our own airmen.

Unquestionably we have barely tapped thus far the potentialities of American industry, largely because of inefficient methods of procurement by the Army and Navy, which demand much hand

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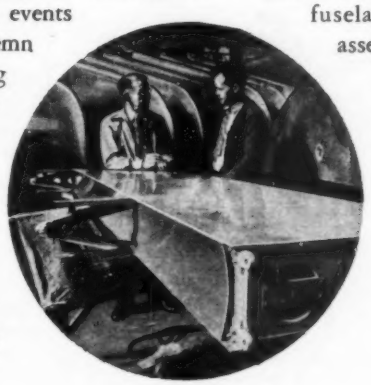
This is being emphatically confirmed wherever war is waged today. From the events since December 7th one solemn fact stands out as a warning to us all. *Unless and until America is the most powerful nation in the air, our safety, our freedom, and our standard of living will not again be what they have been in the past.*

. . .



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P. W. Litchfield

President, Goodyear Aircraft Corporation

work and a high degree of skill by a large percentage of workers. The vast and unnecessary number of changes in design during the process of manufacture attest the failure in foresight of the armed forces and of the former Office of Production Management, which have been handicapped by lack of organization, aided and abetted by procedural red tape.

The Truman committee in its report said there was no intent to criticize any individual in the Services or any manufacturer. The chairman likewise subscribes to the statement that "all of them have done a creditable job insofar as the methods followed have allowed them to do so."

Failures and shortcomings must be examined nevertheless in considering the possibilities of meeting war demands by mass production. Our pre-war plan called for production of approximately 30,000 combat planes annually, to be reached in late 1943. That program has been stepped up several times since war came and now demands radical changes in our methods.

Prior to September, 1939, because the services refused to consider the airplane as more than a supporting weapon; because of national pacifistic tendencies; and because of a lack of money for aircraft, both the industry and the service procurement agencies were operating on a small scale.

Since that time, however, the industry has had all the orders it could handle, and since May, 1940, when the President fixed the aim at an air force of 50,000 planes, with industry geared to produce that many every year, the armed forces have had more money for planes than they could contract to spend.

For the subsequent failures to meet either American or Allied demands, the Senate committee found several primary explanations. Apparently there has never been any real planned and co-ordinated program for the production of aircraft. Both the Army and Navy have tended merely to buy what the manufacturers had to offer. Though it was formed to organize and manage production, the OPM served as a mere rubber stamp. After placing orders totalling billions and co-operating in Government financing of plant expansions to the extent of nearly a billion dollars, they failed to follow up and left the problem of getting the airplanes made to the manufacturers.

The committee found that since manufacture was started with the premise that mass production is impossible, the plane was often designed without proper regard to its adaptability to production.

Rubber and soft metal dies are generally used in many processes for which steel dies would be more efficient. These must be supplemented by skilled hand labor, and waste tremendous quantities of aluminum. One company official asserted that the method wasted as much of the metal as it used in the production of bombers.

Steel dies are much more accurate and efficient, but are costly and require months to make. And the manufacturer has learned through bitter experience that in those months so many basic changes in design will have been ordered that his steel dies will be useless.

Costs under the present system tend to be astronomical, with four-engined bombers costing completed from $477,000 to $1,161,000 each and pursuits as much as $120,000.

Under the present system, the manufacturer is continually harassed by hundreds of detail changes required by the services, many of which are either unnecessary or should have been foreseen. By the War Department's own statement, Boeing's B-17 is a design about five years old and the company in January, 1940, was tooled up for quantity production. Yet in 1940 only a few Boeings were delivered to the Army, although they had been under service tests for five years.

Some of the specific difficulties faced by the manufacturer are indicated by an instance cited by a manufacturing executive and related by the committee. It is remarkable that this executive made no criticism of the service agencies involved and indeed seemed to feel that the delays were inevitable. The committee related:

"The development of the armament on the rear cockpit of a plane manufactured by the company was one of the stories told to show the situation wherein production delay was occasioned by specification changes. It appears that the original specifications called for one .30 caliber machine gun, manually operated, in the rear cockpit. While the plane was still in the design stage it was decided that it should have two .30 caliber machine guns.

"Subsequently, it was decided that one .50 caliber machine gun would be better than two .30's. Still later it was apparent that two .50 caliber machine guns were needed, so this change was ordered.

"Experience proved that at high altitudes it was impossible to handle these heavy guns, so a power turret was ordered to swing the guns on a horizontal plane. Later experience showed that it was just as difficult to move the guns vertically as it was to move them horizontally and that the turret would have to be powered for vertical as well as horizontal movement.

"This evolution resulted in many delays and an inestimable loss of production, but unquestionably resulted in the development of a fine power-operated turret. Some who are perhaps unduly critical say, however, that the need for such a turret has been apparent for many years and it should have been specified originally."

Original specifications for the same plane called for a device for the analysis of the exhaust gases. After a quantity had been ordered the Army directed their removal as unnecessary and because they added between $200 and $300 to the cost of each plane. This change involved more than 200 detail changes.

At a hearing on the west coast one company official testified that increases in armament requirements for a bomber were so great that the plane had to be almost entirely redesigned to accommodate the extra weight. The examples could be multiplied by the hundreds.

A number of possible explanations were found for the fumbling approach to the problem of military aircraft development. One was the suggestion that there were too many fingers in the pie. Not only are the Army Air Corps' matériel division, the ordnance department, and the signal corps involved in furnishing equipment, but specifications may be drawn by several people. Each is concerned primarily with guns, or radio equipment, for example, and the final specifications result from a process of balancing and counter-balancing.

There are many instances of lack of co-

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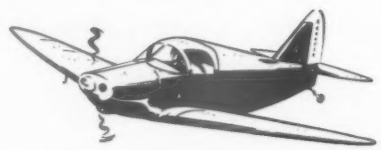

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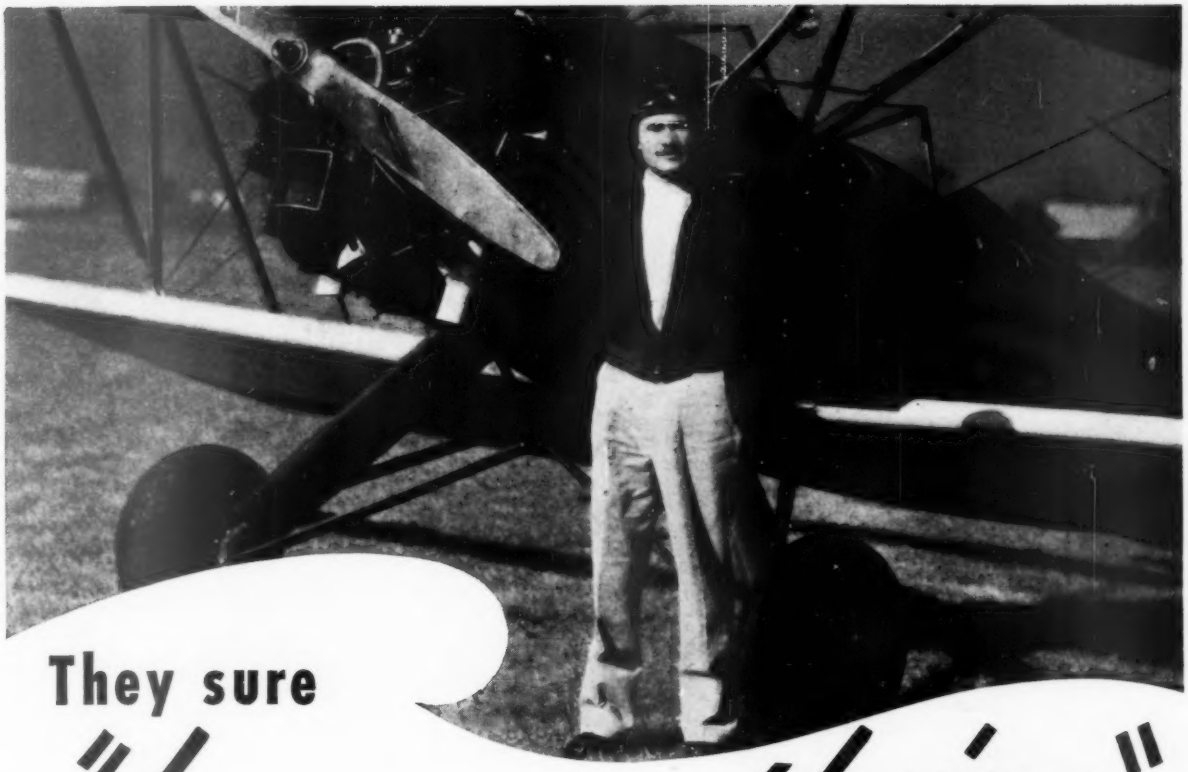

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Tuskegee Institute purchased its UPF-7 Waco trainer in July, 1940. *Fourteen months* later its log book showed some interesting figures:

In 267 days the ship had accumulated 1475 hours, 26 minutes of operation . . . an average of 5 hours, 53 minutes per day. The ship was flown forty-nine consecutive days for a total of 229 hours, 17 minutes. Highest daily record, 13 hours, 45 minutes. During these 14 months, the Waco had three periodic checks and engine overhauls. At the last check, the Waco needed only normal reconditioning. Its general appearance was good.

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ordinated planning and proper organization, and the manner in which development and production have been hindered by short-sightedness.

Our armed services have always seemed extremely reluctant to accept or develop new ideas until they have been fully proven to be not only desirable but necessary. Even after foreign governments were building planes with four and even eight machine guns, our standard was two light guns. Many of our difficulties in adding arms stemmed from the fact that designs allowed for a weight of only two weapons. As late as 1940 our services still claimed that leak proof fuel tanks were not worth their weight, although the Nazis had adopted them and the British had found it suicidal to fight in planes lacking this equipment. In 1940 our armed services did not consider armor worth the weight it displaced in gasoline, and many of our planes still lack this protection.

Although the Moss supercharger (to permit high altitude operation) is one of the highly regarded developments in years, the inventor, Dr. Sanford A. Moss, complained last June that high-ranking military officials remained cool to his device for many years. Although the Navy takes credit for the original development of the dive bomber, the commonly told story is that this American design was actually ruled out by the Navy as ineffective until it had been proved abroad.

The manner in which we have failed to make full use of the actual existing production facilities of numerous small manufacturers is another story and too long for detailed recital here. It can be said in summary, however, at the present time everything is being done that can be done under existing conditions to speed production by 19 favored manufacturers of military aircraft—but the committee found that there were more than 60 aircraft manufacturers who had been unable to secure any substantial place for themselves in the urgent effort to expand our aerial defenses.

The same absence of a planned and co-ordinated program which has figured in other difficulties is a primary explanation for this concentration on the larger manufacturers. Other explanations include an apparent ingrained distrust of small companies, a lack of knowledge of their facilities, reluctance to place a greater supervisory load on already overworked Army and Navy personnel and the inability of the smaller concerns, because of inadequate resources, to sell their designs to the Government.

The answer to the valid problem of supervision is the Civil Aeronautics Administration. A CAA survey of facilities should require a month at most, and the smaller manufacturers have indicated they could begin production within three months after receiving orders.

Merely to criticize would be futile if conditions as set forth here were impossible to remedy—but they are not at all. The exigencies of war already have started a trend toward reorganization of methods and policies to conform to military needs. The Truman Committee advised specifically: "By streamlining methods somewhat, allowing easier presentation of new developments, by standardizing types, by encouraging production methods and by using to the fullest extent the facilities of the small companies and the Civil Aeronautics Administration, the production rate can undoubtedly be quickly increased to give our forces in the field the equipment which they so vitally need."

END

New Aero-Medical Test Equipment

USE of a new device called the "oximeter" is speeding up testing of new oxygen equipment for combat crews in the stratosphere. The instrument is used as a "watch-dog" in aero-medical research and was developed by the Army's engineers at Wright Field working in collaboration with the Cornell Medical College in New York.

According to its originator, Dr. Glenn A. Millikan of the Cornell Medical College, the key to understanding its working principle is revealed in its ear-unit which is u-shaped with a tiny exciter-lamp on one side, and a light-sensitive photocell on the other. This whole device clamps on the lobe of the subject's ear, so that light from the lamp shines through the lobe into the photocell and reveals the actions of blood changes inside a person's body.

"The oximeter," Dr. Millikan explains, "capitalizes on the fact that blood changes color as its oxygen content changes—normally saturated it is bright red, but as more and more oxygen is lost it shades off to deep purple.

"Purple passes less light than red, so any change in the oxygen content of the blood alters the intensity of the light which shines through the lobe of the ear. These changes are relayed from the photocell in wires leading through a box of resistance coils to a galvanometer.

"There is a lag of from one to five seconds between a true reading and the actual conditions of the bloodstream. This is the time required for blood to circulate from the heart to the ear.

"Since light obviously can penetrate a thin lobe easier than a thick one, it is necessary to determine the thickness of the subject's lobe at the beginning of the experiment. Lobes are classified as shell, wafer, thin, medium or thick, so that the proper scale reading on the galvanometer can be chosen."

The tests are all carried out inside high-altitude chambers especially constructed to simulate on the ground altitudes that our combat flyers will encounter when they go into battle in the stratosphere.

The value of the oximeter to aviation medicine both in aero-medical research and the actual art of teaching flying personnel the hazards of anoxia, has been established. Readings can be taken at will, within an accuracy of approximately five per cent, without interupting regulation tests inside the chamber.

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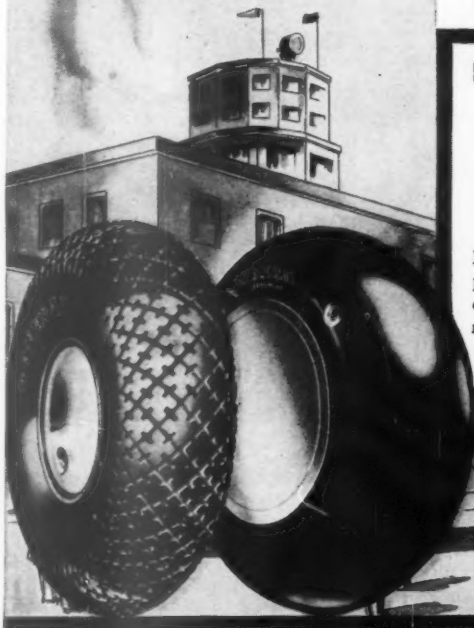

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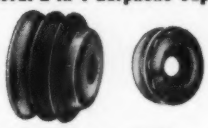

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CELESTIAL AIR NAVIGATION — This important field of Aviation has developed rapidly during the past year. Since the beginning of the second world war it has been apparent to the government that a critical shortage of air navigators existed. Immediately after December 7th, 1941, marking the actual beginning of the world war for the United States, the government began to survey the field and draw on navigation schools for air navigators and instructors. Airlines established Transition Schools for the purpose of practical advanced training. Former students of "Pan American College of Celestial Air Navigation" are now in various quarters of the world. Some are ferrying bombers to England and allied countries; others are instructing in the Army Air Corps or with Transition Schools for advanced training. Never before has navigation of the air offered such opportunities as the present.

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**REMEMBER
PEARL HARBOR!**

Long Drop

(*Continued from page 48*)

The Gaertner Scientific Corporation gave him an altimeter, accurate to within a 100-foot lag beneath the 5,000-foot level. This he wore on his right forearm to call off altitudes at different levels during the first fall.

A Rauland radio transmitter and a special microphone designed by B. Wallenta of Kellogg Switchboard & Supply Co. was obtained to carry his broadcast of altitudes and sensations, as he fell, to a recording disc on the ground. Transmitter and amplifier were added to his kit.

Heartbeats, the scientists decided, should be picked up by a transmitter worn by Starnes, amplified and caught on an electrocardiograph recorder on the ground. The radio equipment was perfected by Thomas L. Rowe and Walter B. Varnum of radio station WLS of Chicago. Starnes purchased the amplifier for the transmitter. Dr. Carlson loaned his electrocardiograph recorder for a graph of Starnes' heartbeats from a radio receiver on the ground. The Federal Communications Commission gave them special authority to conduct these broadcasts of Starnes' heartbeats and voice.

Starnes bought a specially built 16 mm. movie camera, which operated at 65 frames per second, to record his fall. Burgess Battery Company's chief engineer, H. E. Lawson, designed batteries to operate the radio and movie equipment.

They decided to activate a stop watch, to record the time elapsing from the start of the jump until the 'chute opened, by attaching a six-foot static line to the plane. It was stopped by another line pulled by the opening 'chute. By use of this device, it was shown that Starnes fell 29,300 feet in 116½ seconds before opening his parachute. It took him two minutes to fall the remaining 1,500 feet. At the instant of pulling his 'chute, his speed through the air was 130 m.p.h., having reached a terminal speed of 230 m.p.h. at one point in the free fall. It was made at Northwestern University under Starnes' direction and furnished to him.

He designed a pneumagraph to record his breathing and had it made up to specifications at a cost of $233 to him. An aneroid was later added to the pneumagraph by Gaertner under Starnes' direction to record the rate of descent from the time of the jump until the 'chute's opening.

Weber Brothers Metal Works contributed an aluminum breast plate specially designed to protect the pneumograph and barograph from mechanical injury. The designer: Starnes. The plate has ridges in it into which the riser straps fit, protecting the wearer.

With the co-operation of Paul F. Meyn of Gaertner, Starnes spent a year working out a combination windbreak and oxygen helmet. It comprises two breather bags around the head, with a special built-in flutter valve and microphone. It holds the mask in place and protects the face and head in the subzero temperatures of high altitudes.

The Erpenbeck & Segessman Company supplied the 'chutist with a special harness—also designed by Starnes—which permits rapid dumping of the heavy excess equipment in case of trouble with the 'chutes opening.

All this material was accumulated bit by bit. But the final job was the securing of an airplane that would take the 'chutist into the stratosphere. Word of Starnes' idea got about. Friends started supporting his once-laughed-at suggestion. When the officials of Phillips Petroleum Co. heard about it they offered their Lockheed *Lodestar*, powered by two 1,200 h.p. *Wasp* engines with two-stage superchargers.

The plane's door was designed to open inward easily. It was made especially for the purpose. A telescope was mounted in a window at right angles to a special sight-finder in the pilot's compartment, the latter being lined up with the fore and aft axis of the ship so that Starnes would be sure to land at least *near* the field.

Targets were arranged on the ground a minute apart, three in a line. Pilot and jumper knew when the first passed across the field of vision they could get lined up and they had two minutes before the jump. The second meant there was one minute left. The third meant *jump*.

This completed preparations for the jump that made headlines throughout the country—the jump that climaxed a most thorough program of preparation. The success of Starnes' long, dogged efforts is history now. But we can't help wonder what he felt, how he controlled his fall in that magnificent descent at terrifying speed. Here's how he described his experience, one he insists will become common to 'chutists before long:

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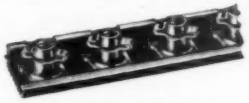
Self-Locking Nuts for  *application in all industries*

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Just before leaving the plane, Starnes becomes anxious and tense. Will the plane be steady? Will he get out of the door smoothly? As the third target approaches, his mind clears to fine-steel sharpness. He leaves the plane in a low, flat dive, head first in order to clear the tail group and have better control.

There's an empty feeling at first. The sound of the engine quits the moment he leaves the ship. He feels the slight tug when the string that starts the stop watch breaks. Five or six seconds after he leaves the ship he realizes when he's reached his terminal velocity. He feels the wind pressure on and crawling about his body as it turns, tumbles and twists. The air gives his body much the same sense of warping you get when you stand in the prop wash of a 400 h.p. engine, lean against the wind and turn the body slightly to present larger and smaller areas of resistance.

He howls but he can't hear. The air rushes past his ears in a loud, vibrating, bobbling noise that's low-pitched, roughly like the sound you get when you stick something flexible in the rubber blades of an electric fan.

The horizon rises, when he is in a position to see it. The earth spreads. While he's falling face downward he can identify many of the objects on the ground. Once Starnes amused himself by counting automobiles.

As he nears the lower level he senses the change because the ground seems to be coming up faster, and the horizon appears to rise more rapidly. Through practice he has learned to judge ripping time to within 400 feet of his selected 2,000. He looks at his altimeter to see whether his guess and the altimeter coincide.

There are three basic positions for the body in falling, although most falls incorporate parts of all three. Best is a slow, deliberate end-for-end fall. Starnes says it's comfortable.

Second there's the flat spin with the body at a low angle, the head down. It's frightening, violent. 'Chutists recover from this by extending legs and pushing out elbows to get them out of the body wash and break up this type of descent. Jerking the 'chute open while in one of these falls may cause it to twist like a rag being wrung out and is liable to yank the body sideways rather violently.

Third and fortunately rarer is a somersaulting fall in which legs and arms are tucked in like a ball. Since this approximates a sphere and spheres offer less resistance than flat objects in dropping, the body somersaults on down at increasing speed. The 'chutist tries to resist it, tenses instead of relaxes. Terrified, seeking relief, he may pull the rip cord. But by this time he's revolving so rapidly that his turning wraps the lines and 'chute around his body before the canopy can open properly and the human "ball" will plummet to earth. When Starnes finds himself in this type of fall he simply relaxes, lets the wind straighten out his legs and soon he's back in the desired end-for-end position.

Thus falling in the manner experience has shown to be safest and most comfortable, Starnes tries to find his body position in relation to earth as ripping time approaches. He prefers a time when he can fix his position in relation to the earth's surface and rip at a time when the topmost part of his body is coming up. This results in the opening 'chute pulling the body up straight and there's less possibility of becoming temporarily entangled in the shroud lines or of the body being jerked to one side too sharply when the canopy opens.

The body is relaxed at ripping time except for the neck and head, which are taut to assist in preventing the head from snapping in any direction. He pulls the cord, feels the jar of the container opening. Then there's a terrific tug! Following this tug he looks up, and if the pilot 'chute has completely settled on the roof of the canopy, he knows that he blacked out momentarily when the 'chute opened, as is usually the case. If it's bouncing around, he knows he didn't. There's no ill effect or pain in these momentary losses of consciousness. It's simply a case of the gravity pull being greater than the pressure forcing the blood to the head for an instant. The blood rushes briefly to the flexible stomach. It's not like a black-out in a plane. It doesn't have the blur. You're out and back again before you know it. The only reaction Starnes experiences from a black-out is a "gone" feeling.

After noting the pilot 'chute the jumper checks his equipment rapidly. He's always ready to dump his full reserve of equipment in case trouble starts. After the first 'chute, the one in back, opens, the jumper rips the second cord, that of the 24-foot one in front, and helps it out, since it doesn't have a pilot 'chute.

With both canopies spread taut he turns slowly, reaches up as high as he can get hold of the riser straps, and as he nears the ground he crosses his arms and turns if he's not facing the direction in which he is drifting. With knees slightly bent he awaits contact with earth. Just as his toes touch he pulls down hard on the riser straps to lift the body. He tries to land with all the springiness he can for the same reason that when you jump from a height you try to light as softly as possible, minimizing the jar.

Sometimes the pressure of the straps restricts blood circulation in the legs and the feet and legs do not have the spring-resistance that they would normally have with good circulation.

Starnes checks his instruments, finds that his fall has set a new record and—more important—pioneered the way for a new future method of military 'chute work!

END

Cloud Faces

RANDOLPH FIELD meteorology instructors use blackboard cartoons to illustrate various cloud formations. They believe cadets learn most easily by associating faces with clouds. Thunderhead clouds are represented by fierce, frowning faces, while "friendly" clouds are smiling faces.

THE ONE SCRAP I fear

Afraid of Jerry? Don't make me laugh! Afraid of their flak? Hell, no! Afraid of *anything?* Well, mister, there's one scrap I keep thinking about—and I may not even be in it . . .

Many an R.A.F. flyer knows his family back home will be in a bad spot if anything happens to him. Bills to pay — medical care — even the bare necessities of living.

The R.A.F. Benevolent Fund was established to meet this urgent need —which a government under stress of war cannot meet adequately or in time. Whenever a member of the R.A.F. or American Eagle Squadron is killed or wounded, the Fund responds promptly, relieving distress in all ranks of the Air Force and their dependents.

This fund depends wholly on private contributions — *your* generosity. The men who fly the Spitfires and the Hurricanes are not afraid to fight. Don't *you* be afraid to give.

All donations will be forwarded to the British Fund IN FULL, without deductions of any kind for overhead or administrative expenses, which have been underwritten by sponsors. The space in which this message appears has been donated by this magazine.

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"Never in the field of human conflict was so much owed by so many to so few"—Winston Churchill

(This space contributed by the Ziff-Davis Publishing Co.)

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A Million for Research

(*Continued from page 53*)

The laboratory also occupies itself with the testing of plastics, wood impregnated with plastics, cloth impregnated with plastics and new metals. Point is made of the fact that the laboratory does not attempt to invent these materials but that it tests them to discover whether or not they can be put to practical use in airplanes.

"We must know the physical properties of the submitted material, the adaptability to aircraft, its availability, its price and the consistency of its properties," Dr. Krivobok declares. The last is most important. It is not only a question of what the material is, but how long it will remain what it is, and for what period of time. The laboratory will not hesitate to present its findings to manufacturers of materials with an eye to making them more suitable to aircraft use.

"One of the problems which is of first importance to mass production is getting consistency of properties. For instance, we may test a sheet of given material today, find that it is satisfactory, and tomorrow's shipment of what is supposed to be the same material will differ in its ability to form because somewhere, somehow, this property became altered.

"Our research is designed to show what we need and eliminate extreme variations in consistency where such consistency is necessary to safety and to production methods. If we find that a certain sheet of metal will stand certain stresses and another piece supposedly exactly the same will not, we will have to engage the supplying industries in cooperative effort to solve the problem."

Carefully and fairly, it was explained that mass production of materials for airplanes is a difficult matter, and that variation in properties may well be expected.

The research laboratory studies certain new designs and reports on whether or not these designs can be executed. In this connection, specified parts will be manufactured to exact scale and suitable tests will be applied. If tests show that they will not stand up under stresses for which they are designed, reports will be sent back to the engineering department. Much attention is centered on the forming of certain materials, which presents intriguing problems. Recommendations are made, after studies are completed, as to what has to be done to make the part or how to alter the design.

One part of the laboratory's study has to do with the effects of chemical treatment on metals. Most metal used in aircraft manufacture receives treatment to guard against corrosion, to clean and prepare sheets for welding. The company must be sure that chemical treatment is correct and will not injure the original properties of the metals.

In the laboratories of physics and chemistry plastics are given close scrutiny. Many problems arise. If, for instance, a plastic part is designed to eliminate the use of metal or glass, how will the plastic material be joined to the metal to which it must be attached? This is just one small problem out of thousands which must be licked.

The laboratory is looking for substitute materials at all times. The search revolves about finding cheaper, lighter and more durable goods, metallic or otherwise. Materials must be had for specific purposes. At the moment, there are difficulties arising from too rapid expansion of the country's war efforts. To cite an example, it is very hard to get a certain material currently used in sealing metal plates so that cabins can be pressurized properly for high altitude flying. The laboratory's duty is to be ready with "ersatz" materials when and if acute shortages develop.

"The layman can't possibly understand what a changeover from metal to plastics, let us say, would involve, however," Dr. Krivobok explains. "We are tooled up for metals, and we would have to desert this equipment and tool up for plastics. We would face months of delay, unless we were prepared."

Dr. Krivobok is not one to make any rash predictions. On the question of metals versus plastics, he guardedly says:

"One can't say no, and one can't say yes without qualification when asked if plastics will replace metals. Right now, one of the biggest 'ifs' in the field of plastics is the design of machinery big enough to allow manufacture of large parts in quantity. I believe that if such huge machines can be economically used, plastics have a chance. Impregnated woods and other materials may also be successful, but we won't know definitely for a long time to come."

Some of the answers which must be found before man flies higher and faster are: what may happen to motors and operating systems at low temperatures encountered at high altitudes? How will cabins be heated? What physiological and psychological effects will be suffered by pilots and passengers? How will lubricants function? What kinds of liquids will be safe in hydraulic systems? The research laboratory is now working to find these answers.

What of the wearing quality of the modern commercial airplane? Speaking for the laboratory, Dr. Krivobok replies:

"Any commercial airplane has an indefinite life, structurally, if properly maintained. We won't get the answer to the age limit for many years. Fatigue in airplane metals is not a serious problem in a suitably designed and serviced aircraft because there is such a low ratio between actual stresses and the theoretical stresses against which the modern plane is engineered. The dangerous enemy would be corrosion if we did not guard against it by specially treating the metal and by constant periodic inspection. There is no metal airplane which has been retired because of wearing out of its structural parts although, no doubt, replacement of certain parts is necessary."

In the research laboratory there are sub-departments or divisions. Embodied in the huge building are a complete machine shop, a sheet metal shop, acetylene, arc- and spot-welding groups, wood-

(*Continued on page 81*)

● *The flag that flies on the Spartan campus.*

SPARTAN AIDS IN SPEEDING UP NATIONAL DEFENSE

Training Period Shortened *by* New 6-Day-Week Schedule

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Because it is imperative that trained men be supplied to all branches of aviation in the shortest possible time, SPARTAN School cooperates by placing its training on a six-day-a-week schedule. Each week will include extra training time and the length of the courses will be shortened approximately 20%.

This new, speeded-up training program will provide SPARTAN students these definite advantages: (1) Will get graduates into the industry where they are vitally needed at once, and thus speed up National Defense. (2) Will afford considerable savings to students for room, board and personal maintenance because of shorter training period. (3) Will place students in good paying positions earlier, allowing them to add to their lifetime earnings.

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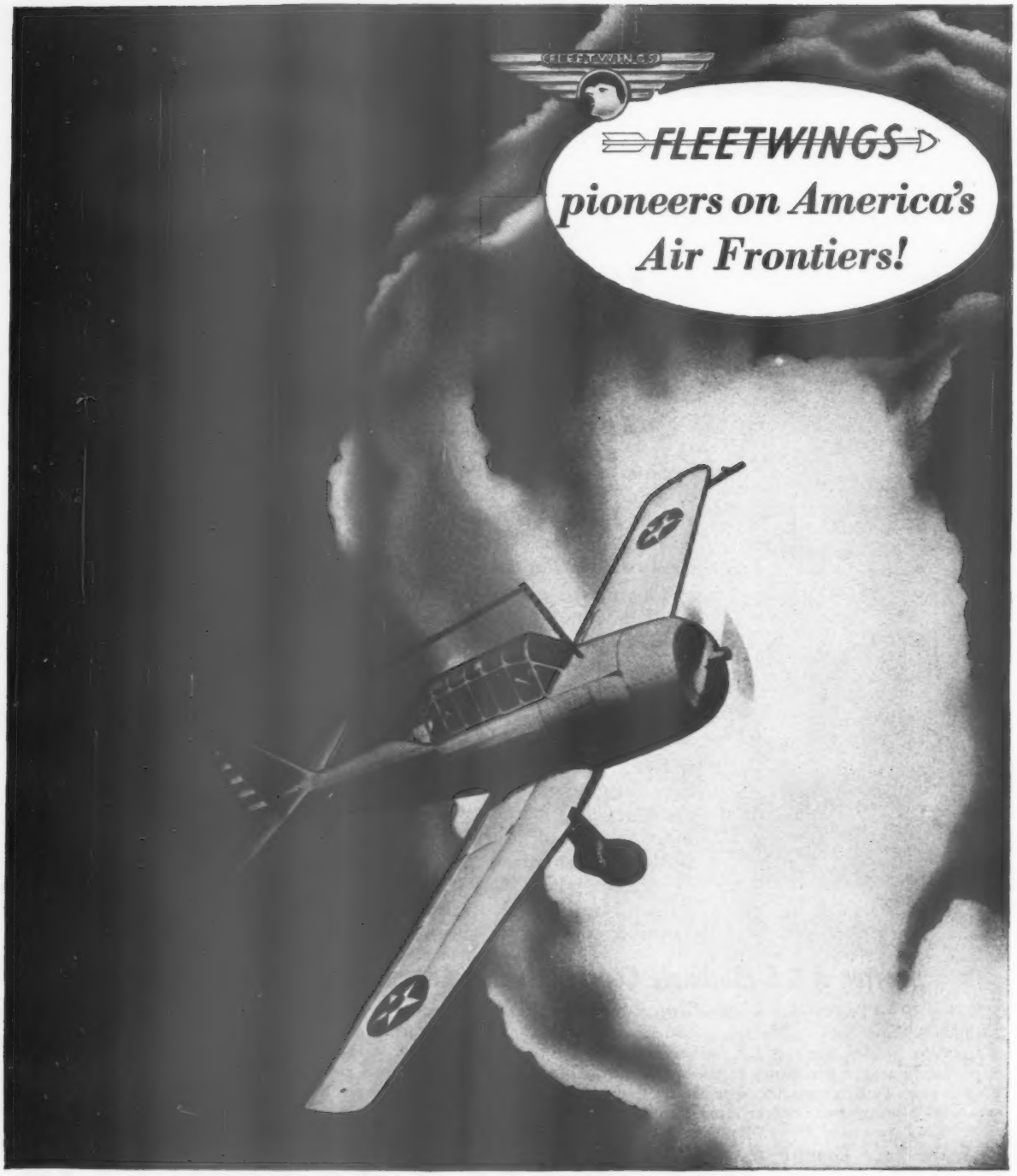

U.S. ARMY flying cadets are well on their way to winning their wings when they get a chance to put this shining new Fleetwings BT-12 through her paces.

She's known by fliers as "in the groove"—aerodynamically stable and easy to fly, sturdy and designed to provide excellent visibility for both instructor and student pilot. *Specifications:* New Fleetwings BT-12, basic trainer, is built principally of *stainless steel* . . . the world's *first* military airplane so constructed. All-welded. Span, 40′; overall length, 29′2″; powered by a 450 h.p. Pratt & Whitney engine.

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You probably read, on p. 47 of TIME, December 15, 1941, the prophetic statement by a well-known designer:

". . . The art of building a feather-weight, super-strength, welded steel structure is growing at a tremendous rate. It is my prediction that all future commercial planes and most military planes will be made of welded (stainless) steel."

Keep an eye on Fleetwings, brother bird-man!

●

A new attack bomber . . . high-speed sister ship to a famous night-fighter that's helping the RAF thoroughly trim the Nazis . . . is equipped with elevators, fins, stabilizers and rudders built by Fleetwings on new, fast, rolling production lines that have tripled output *and* improved quality.

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Fleetwings realizes that lives will depend on the successful operation of aircraft hydraulic equipment at widely varying conditions of temperature, pressure, and relative humidity. Therefore, Fleetwings Hydraulic Valves, for instance, must pass rigid proof tests, body pressure tests, cold tests and torque tests. Dimensions are checked to within two one-hundred-thousandths of an inch. These valves can operate all sorts of aircraft equipment . . . from machine gun banks and bomb doors to "Iron Mike," the automatic pilot.

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"KEEP 'EM FLYING"

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(*Continued from page 78*)

working shop, pattern shop, electrical and instrument shop, chemical laboratory, physics laboratory, mechanical and hydraulic research laboratory, metallurgical laboratory, photographic laboratory and physical testing laboratory. A central office is necessary to co-ordinate all work.

The problem of building testing tools for research immediately becomes apparent. Manufacturers don't make all the testing machines which are needed. In some cases manufacturers, faced with requests and specifications, say that such machines can't be made. The result is that even before research can be undertaken it is often necessary to build machinery to meet Lockheed's own peculiar needs.

The most elaborate of the research machines is the complete "mock-up" of a four-motored airplane which exists, not as an airplane—it has no wings, no tail surfaces and no fuselage—but as a skeleton of tubes, pipes and wires. It is full scale. Four "V-8" motors, simulating the airplane's engines, are used to apply pressures and stresses. Every actuated part on the entire full-sized structure functions under various loads and stresses representing actual flight and landing conditions.

On this same floor is the dual-chambered high altitude cylinder, which is so constructed that air pressure within is reduced to simulate atmospheric conditions encountered by a rising airplane or, inversely, increased. A refrigerating system of conventional design reduces inside temperature appreciably. When it no longer can lower the mercury, high altitude cold is supplied by a combination of super-refrigerating dry ice and alcohol. Inside this chamber, pilots can "fly" to 41,000 feet and suffer a temperature drop to 70° below zero without leaving the floor.

Any type of landing gear can be tested. The test block is designed to meet any direct or side loading conditions and extremely heavy landings. It will accommodate in size any landing gear assembled to date.

In one laboratory electric strain gauges are being applied to a wing section, in another several metals are being vibrated and twisted to determine fatigue, the results being checked scientifically by delicate oscillographs. On steel frames, castings are being tested and others have been broken. Electrically-actuated time clocks stop the mechanism the instant metal breaks during an "all out" destruction test, even if breakage occurs during the night in the absence of an attendant. By this method a full record is made automatically.

In another room a scientist studies steel tapes which have recorded vibration in various parts of a plane during a test flight. In still another, a windshield is being twisted and distorted. Outside the building are huge forms used in testing wings and fuselages. One is 20 feet high, 18 feet long and eight feet wide, and has been used to determine the amount of stress which a single wing spar would sustain before destruction. At the east end of the building is a concrete floor anchored to a depth of 20 feet which takes static load tests as heavy as they come, and is capable of withstanding a pressure of 400,000 pounds on any one spot. A massive vibrator can be set into motion indefinitely to shake a wing to pieces.

Artisans work in the main room on the first floor on lathes, drills, presses and every conceivable kind of equipment, much of it originating within the laboratory walls. The chemical laboratory, where metals undergo baths in all kinds of acids, contributes its own unusual orders. Cloth soaks in vats. Other material is being stretched.

Over all, there is a feeling not only that this is actual work in the future, something that has the essence of tomorrow, but that growth and expansion is occurring by the minute. In fact, the laboratory is growing so fast that nothing is fastened down permanently. Nobody knows when it will have to be moved to make room for something else.

END

"Liberator"

(*Continued from page 49*)

shells and bullets chipping fragments from her decks and sides. Just as we had completed our first attack, the second Heinkel appeared. The first Jerry had not fired a shot at us, but this fellow was more determined. He came in firing as hard as he could, but when we turned our guns on him, he went away. As we were shooting up the ship again, the Heinkel came back and so we had another smack at him.

"I dodged all over the place, maneuvering to let the gunners get their sight on him. Again the Heinkel pushed off and we went on beating up the ship. That happened four times. On Jerry's last attack, he came in head on. The second pilot sitting beside me, kept giving me the ranges—800 yards, 700 yards and so on. When the Heinkel was only 400 yards away, I let him have it. He still came on, and I thought he was going to ram us with his floats and take a chance on getting home himself. But when he was about 150 yards away, he pulled away in a climbing turn, stalled in the middle of it; and went down in a wobbly dive, both his engines smoking badly. He pulled out just in time and flew away at sea level, but unless he could fly on one engine, he never got home.

"By now, we had used up a lot of fuel and ammunition, so we just made one last attack on the ship. The inactivity on board that vessel was almost uncanny and I felt as though we were attacking some ghost ship—not once did she fire a shot at us. I think the crew must have been down below having a meal when we came on her, and had not dared to come up. There was certainly someone steering her during the attack for she had gone round in small circles, trying to dodge our fire.

"Then we set course for home. When we landed back in England, we had been flying for 15 hours."

END

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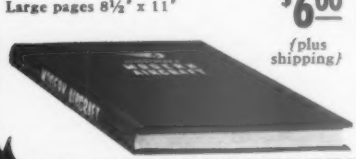

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Japs Are Vulnerable

(*Continued from page 22*)

secured for political reasons (i.e., the licenses secured from Germany in the last few years). Some of the more important licenses held by Japanese companies as well as basic inspirations for some of the better known Japanese planes, follow:

The Mitsubishi organization makes a wide variety of accessories as well as planes and engines, and seems to have the most licenses. Among them: Armstrong-Siddeley (British), Hispano-Suiza (French), Mercedes-Benz and Junkers engines; Levasseur metal propellers; Farman reduction gears and superchargers (French); the well-known British Claudel-Hobson carburetors; Herzmark (German) and Letombe (French) engine starters; Lamblin radiators; and Handley-Page automatic slots. The Mitsubishi-built Mercedes-Benz and Junkers liquid-cooled engines are, of course, the most powerful currently being produced in Japan. Better known as Mitsubishi trademarks, however, are the Type IV, A-14 and *Kinsei* engines, all of which are air-cooled radials of Armstrong-Siddeley and Hispano-Suiza design, but which is which I don't know, although I suspect that the *Kinsei*, rated at 900 h.p., is a Hispano-Suiza. The Type IV, A-14 and *Kinsei* are all used in Japanese bombers.

Besides these licenses for engines and accessories, Mitsubishi also has bought the designs for the French Hanriot series of trainers, Curtiss biplane fighters, Junkers planes of all types, Blackburn reconnaissance and torpedo planes and Messerschmitt fighters. The Army Type 96 twin-engined bomber is a modified Junkers Ju-86K. The Army Type 97 light bomber, also Mitsubishi-built, resembles the American Northrop A-17 attack bomber closely, although Mitsubishi has no license for this (the Northrop probably served merely as general inspiration). Both the Type 96 and 97 bombers, as well as the Japanese Messerschmitts, have seen extensive service in the war so far.

Nakajima's most famous license is for the Douglas DC series of transports, including the DC-4 (the prototype DC-4, the 52-passenger giant the airlines wouldn't take because they thought it was too large, was sold to Nakajima). But Nakajima also has licenses for Fokker transports and, in the engine field, for the Bristol *Jupiter* air-cooled radial, Lorraine (French) radial and Gnome-Rhone, also French. One of the Nakajima radials, the *Kotobuki III*, is a 550 h.p. job which resembles the Wright *Cyclone* closely. But Nakajima has no Wright license and the Japanese insist it is an original design.

A more powerful Nakajima engine is definitely a heavily beefed-up and enlarged *Jupiter*. The Nakajima 96, first Japanese monoplane carrier fighter, has a wing plan very similar to that of the Seversky (Republic) series of planes, but came out too early to have been a copy. The Nakajima 96 single-engined monoplane light bomber is basically a Fokker design. The Nakajima 97 is the twin-engined Japanese bomber that closely resembles the Martin 166. Nakajima is located near Tokio.

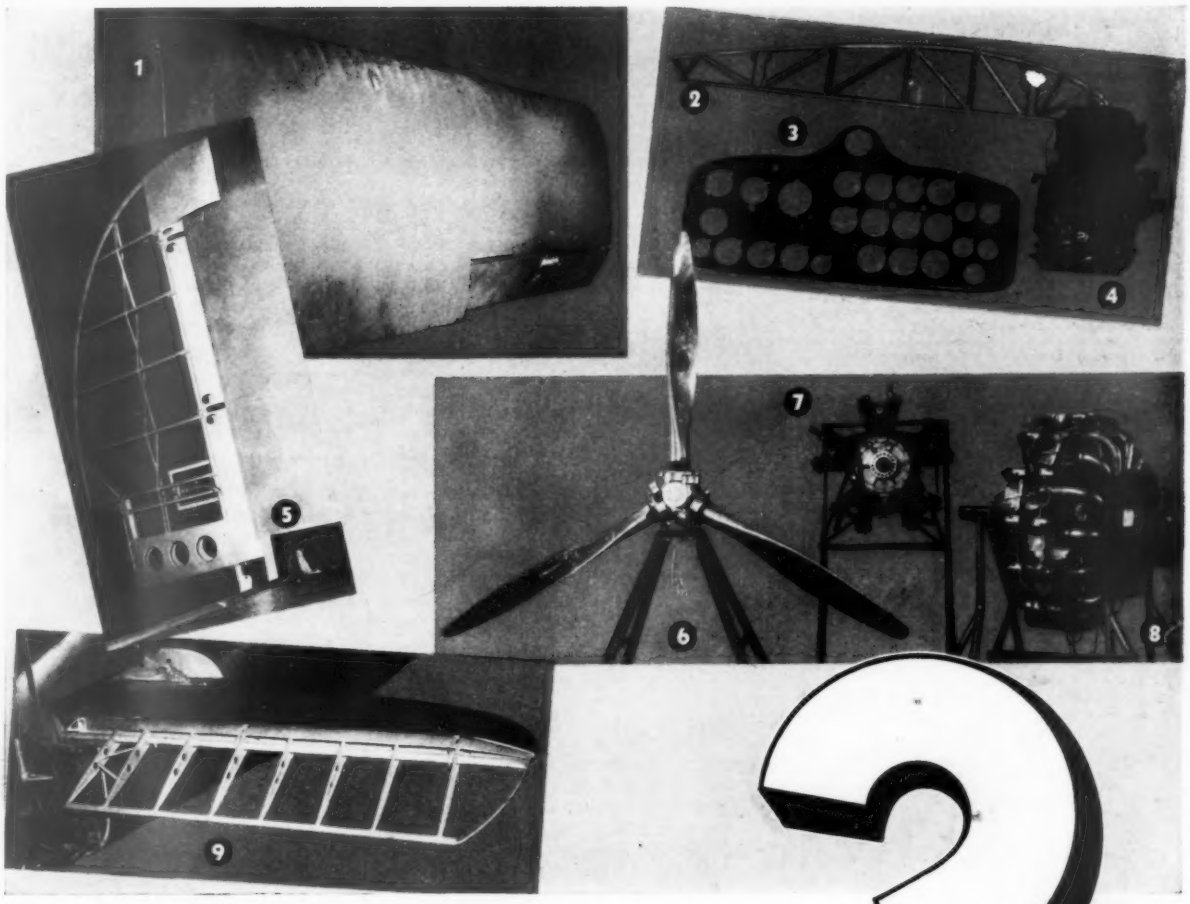
Kawasaki's chief engine licenses cover the German B.M.W. liquid-cooled engines, which are fitted with Kawasaki-made Vincent Andre radiators. The company also has the Dornier patents on metal plane construction. The best-known Kawasaki bomber, Type 93, is a twin-engined monstrosity with an even bigger front porch than had the unfortunate French Amiot, mainstay of the pre-war French air force. Type 93, however, resembles nothing on this earth. But Kawasaki biplane fighters bear a striking resemblance to Curtiss jobs of another age, although Mitsubishi has the Curtiss biplane rights. The Kawasaki plant is in Kobe.

Kawanishi, Japanese agent for Rolls Royce *Buzzard* engines although it does not make them (remember the *Buzzard*? It was a 12-cylinder liquid-cooled type developed for Schneider Cup racers; its present-day descendant is the 1,600 h.p. *Griffin*, power plant for a new type of Vickers fighter) has a weird collection of plane licenses. Among them are: the older types of Short (British) biplane flying boats; Rohrbach-Romar flying boats (a German type that went out some time ago); and Potez C.A.M.S. (French).

The Potez copy is the four-engined flying boat with which Japan about a year before the outbreak of the war in the Pacific began flying one of the oddest "commercial" airline routes in the world—between Fukuoka, in Japan; Palau Island, one of the largest of the Japanese-mandated Carolines; and Timor, the obscure Portuguese-Dutch island in the East Indies which popped up into the news recently when Allied troops occupied the Portuguese half of the island to forestall a threatened Japanese move. There is no commercial traffic to speak of along this route, but it does traverse the strategic area where decisive history is now being made. Kawanishi is also the builder of a Type 97 twin-engined flying boat which bears a striking resemblance to the Douglas DF flying boat of a few years back.

This list does not exhaust by any means the role of licenses held by these four companies, and the others also have rights on many foreign patents. For instance, to it must be added licenses for practically all items of German equipment, from radio to compressed air loading systems for guns. The 20 mm. cannon with which Japanese planes are currently armed is built under rights acquired from the Rheinmetall-Boersig, one of the big German gunmakers. Of other licenses and other companies, the only one familiar to most American aviation people would be the Aichi license to build the liquid-cooled Lorraine engines. These are not, however, powerful enough to be militarily significant, although many were used for quite some time in the Japanese navy. This resumé therefore does present the general picture.

In the past several years, the Japanese have undertaken a series of characteristically energetic measures to overcome the aluminum shortage which has always



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handicapped their efforts to achieve high output of military planes. They have, however, achieved only limited success.

In 1936, Japanese production of aluminum totaled only 7,000 metric tons. It rose to 10,000 in 1937; 17,000 in 1938; 23,000 in 1939 and 35,000 in 1940. The last figure is a Bureau of Mines estimate as no recent official figures have been made available. Last year it was apparently 45,000 tons. For purposes of comparison, Germany in 1940 produced about 240,000 tons of the silvery white metal which is the base of dural, and the USA, 187,000 tons. Japan thus ranks far behind the leading powers in aluminum production. In fact, she approaches only the USSR (about 55,000 tons in 1940) in output. But even here, Japan's position is weaker than it seems at first glance. The USSR is one of the world's leading steel producers and has made extensive use of steel alloys in plane fabrication. The Japanese haven't the steel for that even if they were ready to turn out steel alloy aircraft in quantity.

Japanese aluminum output has been comparatively small mainly because of lack of bauxite, the most important aluminum ore. No bauxite has yet been found on the Island Empire's home islands, nor is there any bauxite in China or Manchuria. The sole sources under Tokio's control as this article is written are on the island of Palau and in Indo-China. But neither is of decisive importance. Palau's maximum possible production is 40,000-50,000 tons yearly, enough for only 8,000 tons of aluminum.

Prior to this war, Japan has imported bauxite chiefly from the Dutch East Indies and Johore, the Malay state immediately north of Singapore. Most of the Indies' bauxite is found on Bintan, a small island within gunshot southeast of Singapore. Japanese imports of bauxite in 1940 aggregated 235,000 tons from the Indies and 59,000 from Johore.

At the same time that plants for the extraction of aluminum from bauxite have been expanded, the Japanese government has also attempted to encourage its extraction from raw material found in the Empire: alunite, alum shale, aluminiferous schist, clay and phosphatic alum. In 1940, however, only one of the many small aluminum companies into which the Japanese industry is divided was actually using such materials. This was the Manchuria Light Metals Co. But the Kokusan Light Metals Co., Asia Light Metals Co., Korea Nitrogen Fertiliser Co. and several others have begun production from these assorted materials on a small scale since then.

Nevertheless, the Japanese aluminum industry is not adequate to serve a big air industry, even though it is supplemented by a surprisingly large magnesium industry (4,000 tons output in 1940, about two-thirds of the U.S. production in that year) and even the capture of Johore, Java and Sumatra—assuming that all this is done—will not altogether solve the Nipponese problem. For capture of these sources does not close the ocean gap between source and plant. The sea haul is long enough and exposed enough to put a heavy burden on the Japanese merchant marine. Furthermore, Japan has suffered from an acute shortage of power for the last three years. Aluminum requires enormous amounts of power to extract—about 10 kilowatt hours of electricity per pound, enough to light a standard reading lamp for about 135 hours.

In other words, there is no prospect of the *speedy* expansion of the industry. Which in turn means no prospect of the speedy expansion of the air industry and of the Japanese fighting services. Which does not mean Japan is or will be a push-over, but does mean the U. S. has a potentially decisive advantage.

END

Letters

(*Continued from page 6*)

NYA resident centers operated in cooperation with the Air Corps at each Army Air Depot. Such centers employ boys who have passed basic civil service exams, assign them to the depots to *work as learners* under Army supervision, for a six-month trial period . . . At Patterson Field the Army wants to jump employment in the center from 400 to 1,000 immediately . . . We want to accomplish the impossible by recruiting immediately 1,000 able-bodied young citizens between 17½ and 24½ years of age for Miami Resident Center, the Patterson Field training unit . . .

LEO B. JACOBS
State Administrator
National Youth Administration
Columbus, O.

Gliding Speed

Sirs:

. . . Mr. Hoyt's article "Are You Forced Landing Conscious" . . . is the first I have seen . . . that mentioned that it was a good idea to know the stalling speed. However I believe it is more important to know the best gliding speed of a plane . . . I have found by trial that the stalling speed of my plane . . . is 40 m.p.h. Best gliding speed is 51 m.p.h . . . and believe the least sinking speed . . . about 47 m.p.h. . . . This all applies to solo flight in my 40 h.p. 1937 *Cub* . . . I believe that if more practice were put into long glides one wouldn't need to be forced landing conscious . . .

H. H. BROWN
Lititz, Pa.

Sirs:

. . . I should like to know how more stall instruction could possibly cut down the number of forced landings . . . Forced landings will always form an important part of any student's instruction and so will stall instruction . . . The purpose of each is completely independent of the other unless, of course, one chooses to call a "forced landing" the attempt to pull out of an unintentional spin due to a stall . . .

ASHLEY G. TROPE
2nd Lieutenant
Air Corps Reserve
New York, N. Y.

END

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War Umpire

(*Continued from page 34*)

TO AIR DIRECTOR MONROE N C
U 39PS FLORENCE. MISSION NR 2. INTERCEPT EIGHTEEN P-39S. INTERCEPT NINE B-25S ROCKINGHAM AT 1115, 9000 FT. OUR LOSSES THREE. ONE O-47 ATTACKED 5 MI W OF CHERAW 1140, 4000 FT. OUR LOSSES NONE. OFF 1050. IN 1155.

ROBERTSON.

The mission is recorded and plotted on a chart by an assistant air director.

Meanwhile another mission, that of the bridge-bombing unit, is in the process of being umpired. Hours ago the 17th Bombardment Group based at Augusta, Ga., had been ordered to attack the Rockingham bridge, planning to drop enough bombs to get at least one destructive hit. As soon as the probable time of attack is known, the air director is notified. He immediately arranges for a qualified ground umpire to be at the doomed bridge; this umpire is told the bomb loading of the planes, their number and type and altitude of attack. While the ground umpire waits there, let's go back an hour or so earlier and sit alongside the squadron umpire, Capt. N. W. Bertleston, as the 37th Bombardment Squadron under command of Capt. C. Baumister roars off for the attack.

The nine medium bombers, loaded to their capacity with 1,100-pounders, head northeast, climbing on their 160-mile run for their target. Over Camden, Bertleston sees a formation of pursuiters coming closer, but no combat takes place; they're a friendly squadron and they scoot away as soon as identification is established. Chesterfield, 20 miles from the target, and no enemy yet in sight. Five miles more—"Oh-oh, here they come," the umpire hears through the interphone. The co-pilot points to the left rear. Six—12—no—18 P-39's have attacked them. The attack is almost completed when the eggs are dropped, and the bombers wheel around for the return home. On the ground, the umpire receives radioed information that the attack has been successful with eight planes; one of the nine having been knocked off by the pursuiters before reaching the bomb-release line.

As the bombers head southwest, with their one known casualty lagging behind, the ground umpire looks up *his* umpire rules. From 9,000 feet altitude so many bombs dropped would mean so many hits. Probable antiaircraft losses around the bridge would lop off a certain percentage; but the final result is one hit on a bridge of this size and that one hit with a 1,100-pounder on a bridge of this type would mean, let's see—he thumbs through his manual and finds the number of hours the bridge would be out. At his command two soldiers with him stretch out a large panel on the ground, indication to air observers that the bridge is out of commission (when it's back in commission the panel will be removed). The soldiers station themselves as temporary M.P.'s and stop all *military* traffic across that bridge. In a tent on the Blue side of the bridge an antiaircraft umpire gets the reports of the batteries which have brought the bombers under fire; and in accordance with umpire rules he, too, assesses a loss against them, one and one-third planes shot down in this case. Well, that's *one* that's certain, but for the one-third plane he marks three pieces of paper; one with "yes," the other two with "no" and draws lots. It comes out "no." He too, with the bridge umpire, sends in the dope to director headquarters.

By this time the bombers have landed. The group commander is interested in the result. "We did *some* damage," reports the squadron commander. "Saw a panel go out as we turned home. Losses? Well, we were jumped by a squadron of P-39's. That gives us one down; had him drop back and follow our squadron home." Bertleston, the umpire, nods confirmation, then reports to the group umpire. Together they make out their report for the air director.

The squadron is still awaiting another mission when the report of an additional loss comes in from Director Headquarters: "ONE B-25 LOST TO 37TH BOMB SQ, AA FIRE, ROCKINGHAM, AT 1120, 10,000 FT."

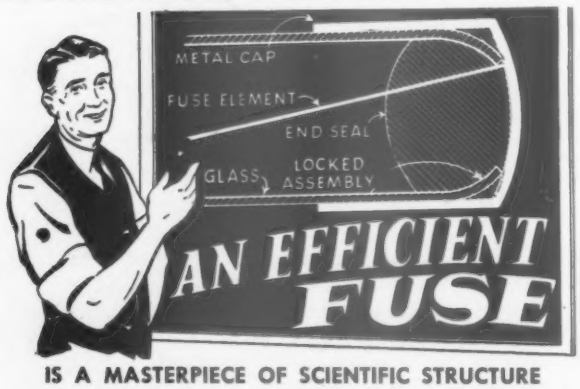
The squadron and group umpire each make the necessary entries as to losses and notify their respective commanders. The group umpire, who also umpires airport losses, has more work to do. This time it's another message from the air director. Nine enemy A-20's are due to raid his airport in five minutes. He notifies no one; the message being marked, "umpire—confidential." Planes at the about-to-be raided airport are given no undue opportunity to take off to escape the bombing. Five minutes later seven Blue A-20's, their white crosses conspicuous, race across the airport. H-m-m-m; should have been nine of them. Two probably knocked off by pursuit before they reached the airport. Well, that's seven times the A-20 bomb load, which puts the airport out of commission a length of time, destroys a certain percentage of planes on the airport and takes out so many maintenance crew men.

Too bad the 37th got caught on the ground; the others were lucky, they're still in the air on missions, except for a few headquarters planes.

At the runway intersection a large cloth panel goes out, to remain there until the airport is again open for business according to the umpire manual. Casualty airplanes are indicated and will fly no more that day. Certain maintenance crews leave the flying line as wounded or dead.

Some time later an observer in a Blue observation plane, high up in the sky and deep in Red territory, sees the panel removed from the Augusta runways. His mission almost over, the pilot returns home, making a last note, "Augusta back in commission 1320." In the observer's cockpit the observer has made voluminous notes. Few have been radioed back to his home airport for fear of detection and interception of the plane by enemy pursuiters. The flying gold mine of enemy intelligence nears its own lines, crosses them at a high, safe altitude and the pilot breathes a sigh of relief. They have been gone two and a half hours, picked up information of an important nature and haven't been jumped yet. He eases back on the throttle, noses down and loses altitude. Then at 8,000 feet, still 30 miles from home, they come—a skyful of P-38's. Long before he can distinguish any red or white crosses on their fuselage he knows them to be hostile aircraft. The Blues, you see, have no P-38's in the maneuvers.

Two pursuiters detach themselves from the formation and ease over to the nowdiving O-47. One pass and then another



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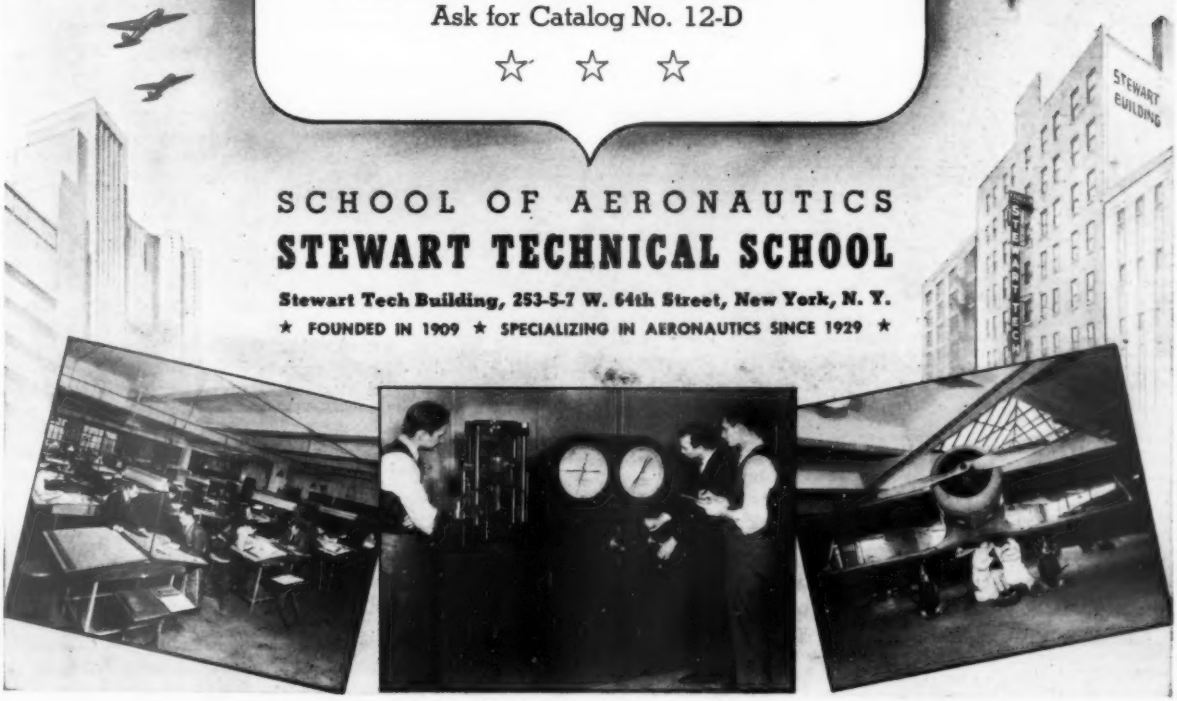

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pass, and they rejoin their formation.

Sometime later the O-47 lands and rolls up to the line. Pilot and observer climb out and report to operations. First to meet them is the squadron umpire. "Any combats?" he asks. "One" is the reply. "Two P-38's, about 8,000 feet, 30 miles west of here. They made two passes and left us. Casualties, aren't we?"

"Uh-huh," confirms the umpire. "And I'll take all the notes and photos you have."

"Tough luck!"

"You bet. But blame the umpire manual; not me!"

The notes, taken at great pains by the observer during his recent tour aloft, are all impounded by the umpire. None may be used by the Blues. It is just as if the observation plane had actually been shot down in battle before returning with the observer's reports. The plane and its team are not allowed to be employed on missions until such time as the rules say that replacements would be received from the depots and replacement centers.

In describing some of the principles on which umpiring is based, mention was made that ground umpires assessed losses and delays to their own ground units as the result of air attack. Although well covered in the umpire manual—a squadron light bombardment attack on a regiment on the road causes a certain number of prescribed losses and hours of delay to the column . . . ground umpires had a difficult time establishing the fact that it was *their* column that had been attacked and not the column directly ahead or in back of them or one on a nearby parallel road. Several methods were resorted to by low-flying or dive bombing air attackers to indicate the object of their attack. Turning on their landing lights, for one, while they would be dropping their bombs, dropping small paper bags of flour or shredded paper, or spraying the troops with lime water or some similar inert liquid. Radio was used in rare cases, but too often the frequencies of the ground force sets were not in the same band as those in the airplanes. Dropping liquids which stain fabric, or even small bags of flour was not always advisable where civilians, afoot or in cars, were also on the highways along with the military forces.

END

Private Pilot

(*Continued from page 24*)

passengers, the inspection of baggage or cargo, the carrying of cameras, fire arms, explosives etc. No camera equipment of any nature will be taken aloft by civil aircraft except with the specific approval of the War Department and under the control and supervision of War Department representatives.

To make a reasonably accurate check of the estimated arrival time proposed before approving the clearance in order to be certain that, considering the speed of the aircraft, the existing velocity of the wind and the distance to the destination, neither too much or too little time has been estimated for the trip.

To report and initiate an investigation of the intent of any pilot seeking clearance who insists on requesting an unreasonable amount of time to complete any proposed trip or flight.

To assign aircraft, whose operators desire to engage in local flights, to the proper areas, and, when practice landings are authorized at outlying designated practice landing areas, to assign a deputy registrar to have charge of the activities at the practice landing areas.

Before granting clearance to call to the special attention of the pilot portions of the Emergency Regulations 60.95.

To secure and transmit all flight plans and PX's required of departing aircraft.

To co-operate with the military authorities to the fullest extent in the clearing and routing of aircraft departing from his landing area.

To notify the proper military authorities of the clearance and routing of any aircraft flying into, across or out of a vital defense area or zone of military operations.

To refuse clearance to aircraft for flight to any point other than a local flying area or a designated landing area, except for special and emergency operations which have otherwise been specifically provided for.

To refuse clearance to any aircraft except in strict accordance with the latest rules and regulations of which he has knowledge.

To refuse clearance to any pilot who has not familiarized himself with all available current flight information relating to the area proposed to be traversed during the flight.

To refuse clearance to any aircraft for departure to any point, or flight over any route, regarding which he has reason to believe that he does not have full information concerning defense zones or other special instructions regarding flight restrictions.

To use such means as he may be authorized to use to prevent the take-off of any aircraft from his point of duty which has not been properly cleared and to report immediately to the CAA and other proper authorities any aircraft which may take-off, or attempt to do so, without proper clearance.

To deputize, with the consent of the airport manager and approval of the CAA, deputy registrars and clearance officers, for whose actions he will be personally responsible.

To work in conjunction with all airport traffic controllers on duty at his airport with regard to reporting clearances, receiving reports of landing aircraft and of aircraft cleared to his station of which he receives notification.

To fill out the aircraft arrival notice on all arriving aircraft from information obtained from the pilot, without reference to his copy of the official clearance.

To secure from each pilot arriving at the landing area the carbon copy of his clearance form issued by the designated landing area registrar and clearance officer at the point of departure.

To thoroughly examine the carbon copy of the official clearance secured from the pilot for any erasures or alterations and to check the information it contains for conformity with the information he has entered on the arrival notice.

To require a pilot to explain in detail on the reverse side of the notice of arrival form any discrepancy noted in the information contained in the two forms, and any deviation from the route, altitude and estimated arrival time, given on the clearance form.

To report immediately to the proper authorities all unsatisfactory explanations of any such discrepancies or any unexplained deviations made by any pilot or aircraft from the approved flight plan or

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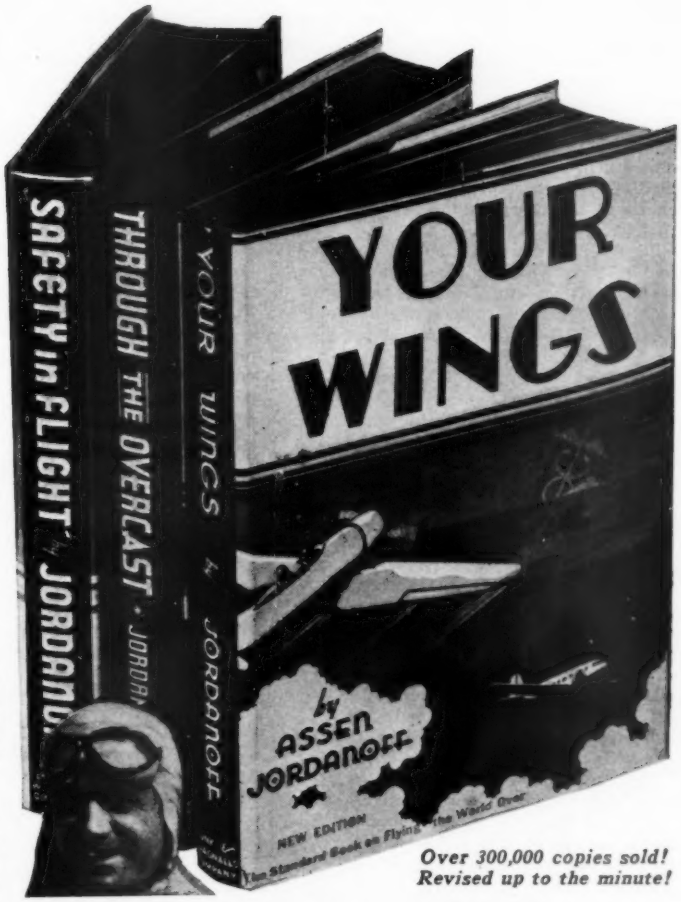

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clearance, or discrepancies of information contained on the official clearance form and the arrival notice.

To secure and transmit any "PX clearance" required of arriving aircraft.

To file the pilot's copy of his clearance after having checked it with the arrival notice, with the original of the arrival notice in a permanent file of "completed flights—incoming," properly cross-referenced to the entry in the landing area register.

To mail, within 24 hours of the aircraft's arrival, the duplicate copy of the arrival notice to the landing area registrar and clearance officer at the point from which the flight of an arriving aircraft was cleared.

To check all copies of arrival notices so returned to him covering aircraft cleared from his area with the applicable clearance, notify the proper authorities of any unsatisfactorily explained discrepancies of information or deviations from the approved flight plan as cleared, and file both together in a permanent file of "completed flights—outgoing" properly cross-referenced to the entry in the landing area register.

To notify the proper authorities of and cause search proceedings to be instituted for any aircraft known to have cleared to his landing area, which has not arrived, or which is unreported, after one hour has elapsed from its estimated arrival time, as reported or which arrives *one hour* or more after the estimated arrival time given on his clearance.

To report and initiate investigation of any flight cleared but not completed by the return of an arrival notice after the lapse of four calendar days from date of departure.

To report to the proper authorities the arrival at his landing area of any aircraft which has not been properly cleared to his landing area.

To enter in the remarks column of the airport register a notation of any unusual happening such as crash, unauthorized flight etc., together with the time of occurrence.

To enter the weather information required, in the space provided on the airport register, at the time of any unusual occurrence requiring an entry to be made in the remarks column.

To make and file a complete report, properly cross-referenced to the entry on the landing area register, regarding any unusual occurrence requiring more information to be available than can be entered in the space provided on the register.

To notify the airport manager and other proper authority of any suspicious acts by airmen or other persons, which come to his attention.

To notify the Administrator of Civil Aeronautics of any new or additional aircraft being based permanently at his landing area and of the departure and change of base of any aircraft departing from his landing area for permanent base or storage at some other point.

To make available to the deputy registrars assisting him, and to pilots having need for such knowledge, all current flight information available and necessary for their use during any flight for which he issues clearance.

To maintain proper supervision over the activities of any aircraft based at points other than his designated landing area regarding which arrangements have been made for his control and specific authorization for such basing and control has been issued by the CAA.

To exercise adequate supervision over all deputy registrar and clearance officers serving as such while he is on duty and to report any derelictions of duty by them to the airport manager and the CAA.

Obviously the airport managers have assumed added importance in civil flying. They must supervise and be responsible for the proper functioning of the guards and the flight-controlling personnel. They must plan the layout, and revision as found necessary, of the local flying areas, and keep up-to-date infor-

(*Continued on page* 96)

Insignia Industry

(*Continued from page* 41)

which we need today. If the designs can help foster it, there'll be designs."

Six foot, six inch Hank Porter creates most of the designs. Sometimes the officers who request a design offer suggestions which are excellent and Porter carries them out. But he usually finds a "twist" or "topper" which surprises and gratifies the recipients.

"How do I get the ideas?" Porter asks. "Well, you tell me. They just come to me, I guess. I study the request, then I write for additional information about the duties of the organization if I need to know. Then I go to work."

The Buffalo-born Porter is very fortunate in that he can draw every character which has ever been created by Disney. Usually, an artist finds his niche with a given set of characters and draws only those henceforth. But Porter, as publicity artist, does Pluto as well as he does Mickey. And Donald is just duck soup to him!

He, of course, makes sure that no two organizations get designs which at all resemble each other. The only clue to the way he thinks up the ideas is his statement that he does "a logical treatment" of an insignia request. A fighting squadron will, therefore, get a pugnacious animal as its mascot; a newly organized squadron would get a fledgling bird.

"I should be doing this," he exclaims. "Say, the highest I've ever been in the air's a roller coaster!"

The second delivery of a design was in 1940. Lieut. E. S. Caldwell, of the office of Chief of Naval Operations, Washington, asked for a design to be placed on the first American motor torpedo-boats. As these boats were known as the "mosquito fleet," the Disney design showed a nasty looking mosquito riding a torpedo. About this time the Alaska Defense Force got an idea that *they* needed something with a punch.

"So we turned out a very sleek seal balancing 'ADF' on its shiny button nose, and everybody was happy," Porter explained.

This really got things under way. From then on, Disney really felt the heat. Hank Porter's six foot, six inch frame was entirely snowed under and he let out a muffled call for help from the bottom of the pile. He got it.

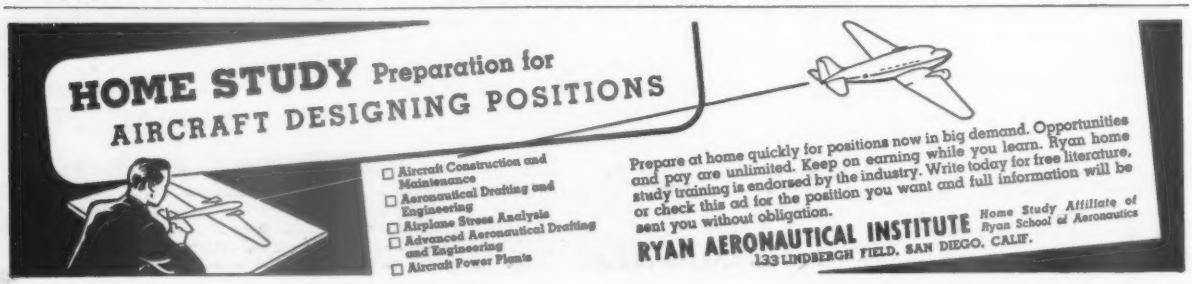
Porter, Goepper, Kaufman and Parks so far have done a lot of creative work, starting with aircraft and running the gamut. They've done their stuff for bombardment and pursuit squadrons, interceptor squadrons, field artillery, coast artillery, submarine bases, mine divisions, antitank companies, reconnaissance squadrons, observation squadrons, parachute battalions, the China air service and the U.S. Marines. The groups carrying Disney-designed insignias—the Air Forces predominate, of course—reach into every part of the globe. In fact, one of the latest requests has come from the Free French Forces operating in North Africa.

Porter says he never knows when a request is coming or where it will come from. Recently, Captain Lord Louis Mountbatten of *H.M.S. Illustrious* (British aircraft carrier) dropped in to see how Mickey, Donald Duck and the Silly Symphonies came to life. He saw Porter at work on an insignia.

"Say!" he exclaimed. "I like that. How about one for the *Illustrious*?"

As the commercial angle is not a taboo in the British Navy and as Lord Mountbatten, by self-confession, is Great Britain's Number One Donald Duck fan, he got Donald Duck—standing astride the *Illustrious*.

Disney and Porter themselves duck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when any publicity gets out about the charitable and patriotic enterprise. Recently a national magazine carried a layout of early designs and a new flood of requests came in.

The operation of the "request mill" is very democratic. A commanding officer of a group may write in, or the lowliest private. In some cases round robin requests come in from every member of an outfit. Porter frames these and puts them on the walls of the offices.

Of course, when the *U.S.S. Hornet* saw *the U.S.S. Wasp* design, there was a mad scramble for typewriters and fountain pens, and a hornet came into being, with quite as resolute and determined expression as that displayed by the wasp.

Many requests come from crews behind the scenes these days—weather squadrons, for instance, and air transport workers. They have no official designations, but are proud of the fact that they "Keep 'em Flying." To these groups go insignias as fast as to combat groups. There's no discrimination.

One recent request came from the *U.S.S. Howard* of Mine Division 19. Again, some red tape was cut, as the boys on board asked for Pluto. They got Pluto, who swims happily through a bed of mines, a whisk broom tied to the end of his tail. And, showing you how far a thing like this can go, Porter and his busy men are currently working on a design for a stamp to be placed on all food shipments being sent abroad under the Lend-Lease bill.

The design shows an American eagle protecting a merchant ship from an enemy plane.

Sometimes the receipt of the design requested draws an interesting letter. This was the case when the seal, balancing the ADF, was delivered to the Alaska Defense Forces. Brig. Gen. S. B. Buckner, commanding, wrote Disney:

"Since the arrival of the insignia all of the seals in the Bering Sea have been out on the ice pack balancing 'D's' on their noses, sneering derisively at polar bears, expanding their chests and cavorting merrily over being chosen to represent our defense forces."

So, if you'll look closely these days, you'll see the Disney designs everywhere, particularly on Army airports. For instance, if you live near Langley Field, Va., you'll see a perky, pipe-smoking Scotch terrier carrying two loaded bombs on the fuselages of the planes. You'll know that this is the Seventh Bombardment Squadron. An elephant putts a shot for the 40th Bombardment Group at Borinquen Field, Puerto Rico. A fat-bellied little Indian shoots a bomb with a bow to designate the 77th Bombardment Squadron, Boise Air Base, Boise, Ida., as any native will tell you. The Eagle Squadron of the RAF has a fighting eagle, wearing boxing gloves, in front of the shield of the United States bearing above it the initials "E.S." A very happy rhinoceros wearing goggles blithely tosses bombs from a tiny airplane for the 43rd Bombardment Group, Langley Field, Va.

One of the cleverest of designs is that sent to Bombardment Training, at Ellington Field, Tex. In this one, a stork is busy delivering a fledgling aviator complete with goggles, who is busy worrying the stork by dropping bombs. Sixteenth Reconnaissance Squadron, Fort Douglas, Utah, boasts of a heavily armed Indian with jutting jaw, ready for action with a bomb in one hand and a spy glass in the other.

And so it goes.

As it has been indicated, the Air Forces started the ball rolling, or the ink flowing, whichever you prefer, and now everybody writes. Just recently, the newly organized 204th Coast Artillery at Camp Hulen, Tex., received an angry little kitten, riding a wooden horse and carrying a toy sword. A turtle, clubbing a snail, was the Disney version of a tank fighting a tank, for the Antitank Company of the 124th Infantry, Camp Blanding, Fla.

Other recent jobs include a centaurette dressed in a military nurse's uniform for the Women's Ambulance and Defense Corps of America. Another good one is a sea horse with a patch over his eye, the insignia for the Survivors' Club. This is composed of those fortunate enough to have been saved from a sinking ship in the current war.

"Let them write and tell us what they want," say Disney and Porter, in a determined chorus, "and we'll do our part. They're certainly doing theirs, and we are more than glad to pitch in with them, even in our small way."

END

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They Deliver

(*Continued from page 28*)

A machine shop famed for its fine precision work on all types of marine motors —widely-known to all eastern amateur power yachtsmen in a more peaceful day —has had most of its facilities taken over by Republic's work.

In several cases, former Republic employees have opened their own small shops and are receiving all the work they can handle from the company—a development that is fundamental in the American tradition of small business and individual enterprise.

A dental instrument company denied a portion of its regular work by the impact of priorities is doing fine work on *Lancer* and *Thunderbolt* parts.

This sort of thing pays added dividends to the general defense picture. After Republic brought the above mentioned sail making shop into the subcontracting picture, the enterprising concern went to other plane builders and booked business on the strength of his relationship and record with Republic. Curtiss is buying a great deal of canvas and fabric material from the concern which, as a result, is greatly expanding.

Similarly all subcontractors, once they are "lined up" with a company, find it possible to book work with other major producers, and these producers can pretty well rely on the sources because they have already been tried and educated successfully.

Private plane makers, with markets drying up and materials scarce, are receiving Republic subcontracts. Some of them have worked for the company for five years and now have regular Republic divisions, floors or production lines.

Huge industrial units, whose production in other fields is known throughout the nation, are taking large contracts. The role of the automotive industry has been widely publicized and its huge capacity and acknowledged managerial abilities are being put to work on a subcontract basis, not only by Republic but by all other leaders of the aircraft industry as well.

As a sidelight to this, it has now been found possible to "farm out" small subassemblies to well-managed, well-equipped automobile dealers and distributors in communities both large and small. When this is done, the dealer is used as supervisor, his foreman becomes foreman on the job, his mechanics go to work and his otherwise idle plant and equipment are drawn into the national victory effort. In addition, all of this setup is saved from economic disaster which now, with the sale of new autos banned, hangs over the entire auto dealership structure.

Other primary aircraft manufacturers —some of them larger than Republic itself—are doing subcontracting work for the company because of their special ability in various lines.

To handle this vital portion of its activity Republic has established a special outside production division, headed by A. H. Weber, experienced aircraft pro-

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duction man who reports directly to George P. Michaels, Republic's production manager. A staff of men comb the entire nation, ferret out possible sources of supply, help to educate subcontractors, consult with them and expedite their work after production starts and co-ordinate the whole program by field contact.

The work of these "expeditors" or follow-up men is among the most interesting in the defense picture. Usually younger men, of a type who are active and energetic and without ties which make it unpleasant for them to be on the road for long stretches, these individuals are selected from the shop or the planning or purchasing staff of the company. Some are brought in from outside—from the automobile industry, for example. They are required to know production methods and problems so that they can see through alibis, suggest solutions for knotty problems and "talk the language" of those with whom they deal. They must have aggressiveness, diplomacy and perseverance, for the failure of Y Company to get out those flaps on time will inevitably mean that the production line back at Z Company will halt—unless Z's follow-up man or local representative refuses to let Y get behind on the job.

There have been numerous desirable results of this subcontracting policy. Among them, according to J. L. McClane, Republic's vice president and general manager, are:

On several occasions, particularly within the past two years, Republic has gotten a flying start on contracts by utilizing the facilities of other companies which were immediately available, instead of waiting for construction to be completed on its own buildings or for the delivery of its own machines and equipment. Moreover, these various expansion steps have been sharply reduced by the use of available outside facilities.

Republic has been able to do its job with fewer employees, reducing its training and supervisory problems and eliminating the importation of workers from other sections. It is estimated that the company would have at least 1,000 more workers if it did not subcontract heavily. Frequently it has been able to obtain better quality work and faster deliveries, because outside firms were specialists in certain types of work.

Outside production has meant Republic could accept bigger orders and make faster deliveries at less expense to the Government. Without its subcontracting program the new $6,500,000 Republic factory might well be at least 50 per cent larger, to the ultimate cost of the Government.

Ralph S. Damon, Republic Aviation's president, typifies, in his opinions, the reliance which his company has placed on its co-ordinated subcontracting program. He believes the big expansion of 1942, within the aircraft industry, will occur in the subcontracting field, just as the expanded deliveries of 1941 were achieved through the bringing into production of the great new plants that all aircraft companies completed during the year.

The national delivery schedule for 1942 will depend on the ability of the subcontractors to make good—and on the ability of the prime contractors to assist them to meet their responsibilities. In his statement on the year-end business situation in the aircraft industry, Damon said:

"The year 1942 will offer the greatest possible challenge to the American defense effort, for it will be necessary to continue the expansion of our production rates without letup.

"Expansion of production to date has been remarkable—a 400 per cent increase in the deliveries of fighting airplanes in two years, for example. In 1942 the defense industries of America will be in high gear with almost all physical expansion of the major industrial units completed. Management faces the job of making the fullest use of these new facilities.

"I have no lack of confidence in the capabilities of American industry to meet the schedules laid out for these new plants and additions. However, just meeting these schedules will not be enough. We have been called upon by President Roosevelt to fill new and greater orders, to improve on existing delivery schedules. To accomplish this, there will not be the time nor possibly the material to build more new plants and additions. Rather, we shall have to do the job with the tools and buildings on hand. This will require development of methods to obtain new levels of efficiency, to bring forward new techniques and to utilize subcontracting and similar devices to a larger extent.

"To a great degree, as 1941 was the year of tremendous physical expansion, 1942 will be a year of expansion in the subcontracting field. The success or failure of the expanded defense effort in 1942 may well lie with success of prime contractors to schedule work outside their plants and with the success of the subcontractors to deliver the goods on time. The efforts expended in 1941 must bear fruit in 1942."

END

Licenses

PREPARED as a special bulletin for FLYING, the following monthly statistics were released by the Civil Aeronautics Administration:

	Feb. 1 1942	1941
Pilot certificates of competency	101,876	67,243
Airline transport certificates of competency	1,589	1,415
Student pilot certificates	99,057	86,269
Glider pilot certificates of competency	164	138
Student glider pilot certificates	509	543
Mechanic certificates of competency	14,270	11,361
Parachute rigger certificates of competency	639	443
Certificated aircraft	25,235	18,958
Certificated gliders	66	44
Ground instructors' certificates of competency	4,822	2,224
Air-traffic control-tower operators' certificates of competency	516	216
Air carrier dispatchers' certificates of competency	423	363

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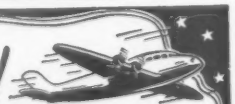

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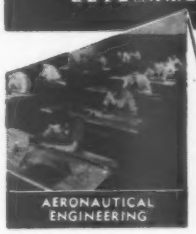
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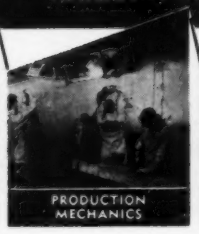
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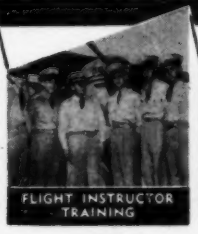
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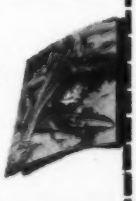

AOPA News

(*Continued from page 56*)

as your new address. If you have had any change of pilot rating—or plane ownership—this fact should also be noted so that it may become a part of your permanent record at headquarters.

AOPA Selective Service Certificates

Last month we announced that the AOPA was issuing certificates to its members for presentation to draft boards. We urged that pilots with considerable experience report their AOPA membership and flying experience to their draft boards. Pilots will find that draft boards will give them special consideration, as pilots are included in a list of specialized technical personnel deferred from Class 1 to Class 2.

The certificate issued to AOPA members is *not* a guarantee of deferment but rather an aid to establish the pilot's record and qualifications with the draft board. In many cases the draft board has accepted these certificates and other evidence and granted deferments. In some cases no deferment has been granted.

Those AOPA pilots who feel that their flying experience warrants special consideration are urged to apply to AOPA for these certificates (issued to members only). They may be of assistance.

In Memoriam

Word has just reached us of the death of fellow member Thomas Hollandsworth. Hollandsworth (AOPA 5219), member of the Dallas Unit of AOPA, was a civilian pilot ferrying planes of the U. S. Army Ferry Command out of Hensley Field. The fatal crash, resulting from a mid-air collision, occurred near Tucson, Ariz. Members of AOPA join in extending official condolences.

Last Call for AOPA Jackets

Members desiring to obtain their AOPA flying jackets with official AOPA wing insignia are urged to write for order forms without delay as we are not sure how much longer these garments will be available. The cost is $5.50. Forms may be obtained from National Service Office. One more delivery of car emblems is expected from the supplier. A new "decal" has been designed and is now in production for members. Those desiring one of the remaining car emblems should place order now. Cost: $1.

Don't forget to read the AOPA Section (available to AOPA members only) for confidential information and AOPA developments.

West Coast Members

AOPA members residing in the west coast area (sixth and seventh CAA Regions) may find it convenient to address their inquiries that are of a local nature to the west coast AOPA office, 424 South Broadway, Los Angeles, Calif., telephone TUcker 8820.

SPECIAL NOTICE
No More Air Marking

At the request of the War Department we urge all AOPA Units to suspend their air marking campaigns. This will conform to the policy adopted by the military authorities. Substitute projects should be adopted in lieu of this activity.

END

Long Hop

FERRYING a new DC-3 from the Douglas factory to Eastern Air Lines in New York, Capt. Fred Davis of Eastern flew the ship non-stop from Winslow, Ariz., to New York in 12 hours. The 1,920-mile hop was made at a cruising speed of 160 m.p.h.

Private Pilot

(*Continued from page 90*)

mation on defense areas, zones of military operations, and the approved routes for cross country flying, locally and also to some considerable distance from their own airports. If their airports are within or close to the eastern and western theaters of operations it will be essential for them to acquire detailed knowledge of special military restrictions and traffic control requirements within these theaters in order to give proper service to flyers basing at or using their airports.

Naturally, the airport managers, guards, registrars and clearance officers and their deputies, and airport traffic controllers will have to be investigated as to citizenship and loyalty, and carry means of identification as is required of reinstated pilots. In carrying out the special duties mentioned here, they will be acting as representatives of the CAA.

It might be well to mention here that special arrangements can be made whereby aircraft can be flown to points other than designated landing areas, and, in addition, can be based there for varying periods of time provided that their operations are carried out under supervision and control of the officers of a designated landing area. The CAA will exert every effort to impose the least burden practicable upon the flying public consistent with carrying out the proper guarding of aircraft and control of flying. Where justified by conditions, a single individual may be authorized to perform all these special functions at least during certain periods.

All this adds up to taking proper precautions against the improper use of private planes and pilot's certificates. It is useless to expand on the damage a saboteur could do in a plane, nor to estimate the amount of information helpful to the enemy that an enemy agent could get in a few flights over defense areas. These are the things we must prevent.

END

Statistics

ACCORDING to one of American Airlines' statisticians, air travelers have saved 1,735 years by flying in the company's airliners.

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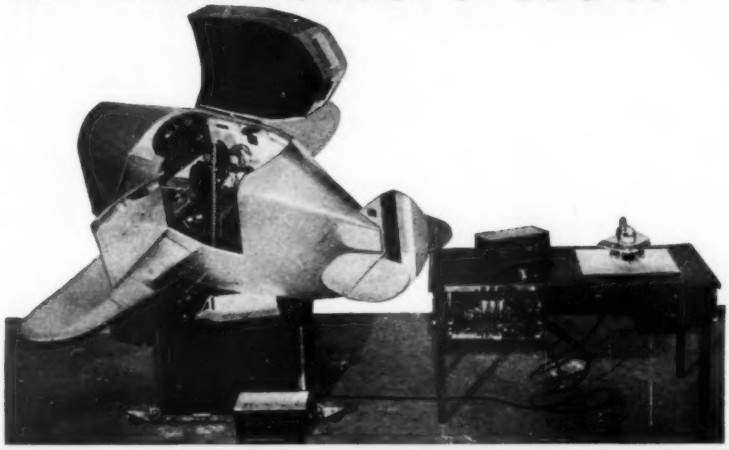

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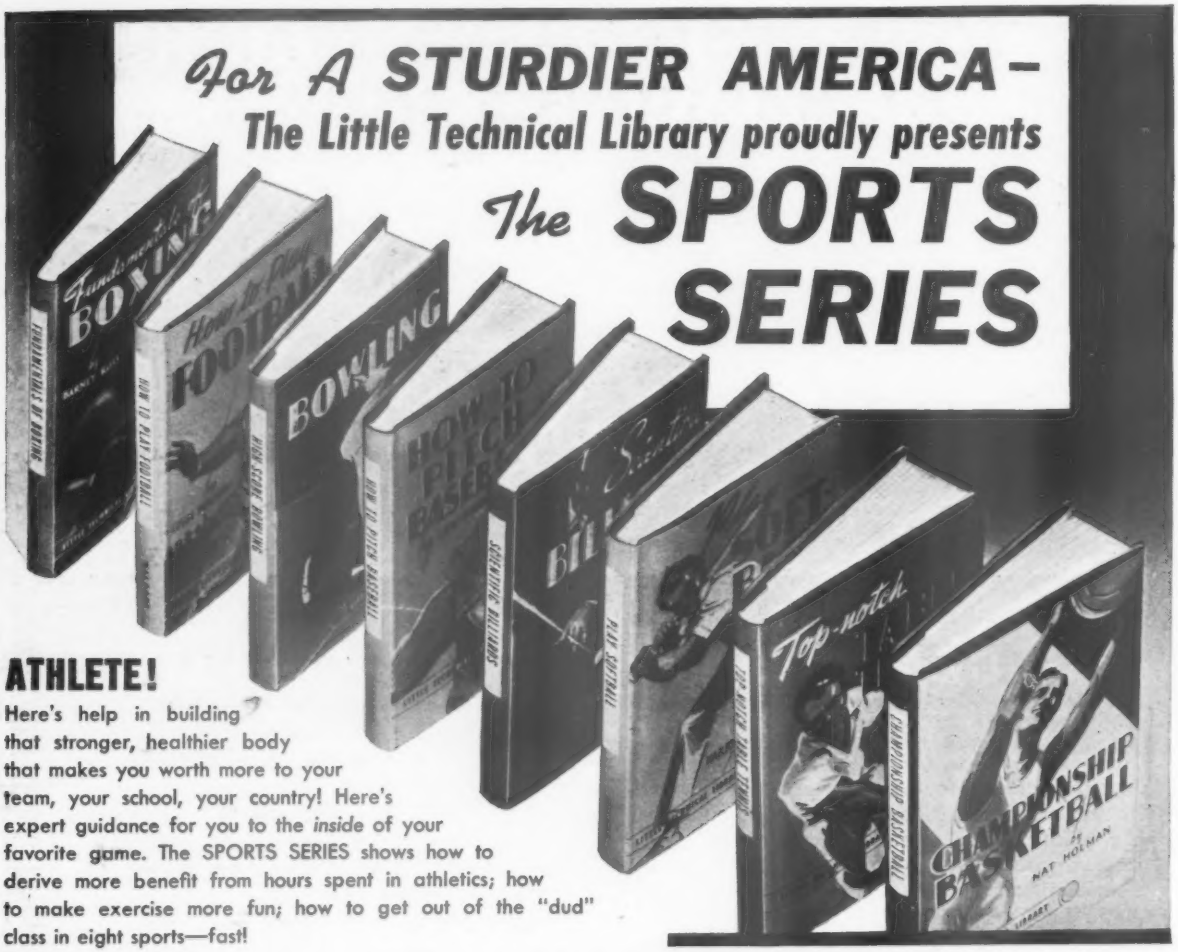

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From Headquarters

(*Continued from page 38*)

cause one newspaper got a scoop on it. While it looks now in retrospect as though prior to Pearl Harbor very few felt we would get into this war, one can safely prophesy that each success of our enemy which puts Americans nearer to having their backs up against the wall brings out more and more the good qualities of our people and kills off the bad. There will surely be some radical changes made by Nelson unless the steps taken by him upon appointment quickly result in marked improvement and definite indications of greater harmony. Maybe it was a mistake in the first place to wash out the work of the Army Industrial College back in 1939. It had worked on plans and surveys for 20 years just to prevent all this confusion.

* * *

The War Department hired 669 new employees on civilian status in a period of one day during the past month.

* * *

The speed with which the Congress put through the huge 25 billion dollar Naval bill and the half-billion dollar loan for China bespeaks louder than words the morale and harmony of both houses of our lawmakers.

* * *

C. D. Howe, Munitions Minister of Canada, stated here recently that Canada is sending a number of twenty-ton tanks to Russia per month, and that Canadian airplane plants are now producing at the rate of 10 planes a day. (However, they do not make the engines up there).

* * *

Aviation veterans salute assistant Secretary of War for Air Bob Lovett, Lieut. Gen. H. H. Arnold and the War Department on the selection of Maj. Gen. Carl "Tooey" Spaatz to head the Army Air Force Combat Command.

Those who served with "Tooey" in Mexico in 1916; who helped him turn Issoudun, France, from a mud-hole into a great flying field in 1917, or who were flying in the First Pursuit Group in 1918 and saw him "blow in" on Eddie Rickenbacker's 94th Squadron and shoot down a Hun before anyone knew he was about, will join in these salutations.

He bagged three Fokkers and was awarded a DSC for gallantry in action. For stamina in flying the endurance record plane "Question Mark" in 1929, he was decorated with the DFC.

Spaatz shuns publicity, but because he is destined to lead many successful aerial assaults in this war, his friends are certain to hear a great deal about him from now on. He talks little but thinks and fights hard. He'll gamble with anyone when it comes to a flying matter, but he always seems to win out. Your boys and mine will be lucky indeed to fly anywhere under Carl's leadership.

* * *

Washington proponents of a so-called separate air force respect the fight Maj. Alexander P. de Seversky has put up for air power, but disagree with him in one respect. Seversky stated recently: "The point that must be made clear is that the issue of a unified high command is something quite apart from the issue of a separate and unified air force."

Definitely, the feeling in Washington is that we will get (in due course) a unified command first, and that this will bring with it a separate, autonomous air force as a co-equal, one-third part of that command for two reasons mainly: (1) because otherwise it will be the case of two tails wagging two dogs and (2) because there cannot be unity of three equal entities if any one of the three is subservient to the other two. In light of this, Seversky, who has been right so often, has this time erred, for instead of being "quite apart" the issue is part and parcel of the whole thought and talk down here—unity of command.

* * *

Washington taxi drivers are doubling up in the rush hour. We are back to "jitney days" for a try out and it works pretty well. Besides affording a ride during rush hour (and a 20-cent one at that), the conversations which go on—the driver taking part—are most enlightening and interesting. Here, as a sample, is one heard this morning:

Tom: "If we, the British and ourselves, have 39 battleships and the Axis only 15, why are we building more of them?"

Dick: "Oh, it's a big ocean and I guess we need them to protect our convoys."

Tom: "Yes, but they are no good near shore any more and what good would it be to have 39 of them cruising about out there in the middle of the Pacific?"

Taxi driver: "You're right. One of my fares this morning thought it would be a good idea to stop building battleships and use the material and skill on airplanes."

Tom: "Here I am, got to get out of here, driver, thanks a lot."

Driver: "My thanks. Gee, I make 85 cents this trip back. Would have had to dead-head if this pick-up jitney business hadn't been allowed."

* * *

Billy Parker of 100 octane gasoline fame, is in town. He flies anywhere at any time, day or night. Feels he is a slacker at not getting back into service, but the Axis don't. They know what the American 100 octane will mean to them and probably wish he had never lived.

* * *

Kenneth S. Clapp, general manager of United States Air Compressor, Cleveland, came here after priorities had shut up his business. He is looking for subcontracting work for his idle plant and men. He was the first man in the 27th Squadron to get a DSC in World War I. His stories of training and learning to fly in Fort Worth, Tex., during the last war brought back old days. They are so similar to those heard in the camps of today, both Army and Navy, that one is reminded how human nature never changes though equipment shifts, guns get bigger and bombs heavier. The human interest of any thousand men in a military unit today is about identical to that of a similar number of men in the time of Caesar.

END

I Learned About . . .

(*Continued from page* 49)

nections, I could have the completed magneto the first thing in the morning. Feeling greatly relieved, I checked in at the hotel, confident that my troubles were over and that I could get an early start on the following day.

During the night the weather turned bitterly cold, and if you have ever tried to install and time a magneto in an unheated hangar with the temperature near zero, you will know what happened to my early start. The job was finally finished around noon and, after heating the engine oil, I hopped off for Indianapolis, feeling cheerful despite the cold.

My cheerfulness was shortlived however, for about 15 minutes out of Muncie, the old trouble began to show up again—not quite so bad at first but gradually becoming worse. This time my patience was at its breaking point. The magneto overhaul had cost $20. I had lost a day's time and I was still far from my destination. The engine revved down to a point where I finally had to make a forced landing in a little field at the edge of the Indiana State Prison at Pendleton, and I had some tall explaining to do to the guards who came running up. I managed to convince them that I was not trying to smuggle out one of their prisoners and wangled an invitation to warm myself. After thawing out for a few minutes, I returned to the ship to see if I could locate the trouble. Upon removing the cowling, I found a slight water leak in the left overhead assembly and decided that a spray of water could have shorted out the distributor blocks. Although I was past feeling confident that I had solved the problem, I fixed the leak, cranked up the engine and took off again. This time I was waiting for the engine to cut out, and it did not keep me guessing long. About 10 miles away from the take-off, it had again settled down to serious intermittent missing and was getting worse by the minute.

The country below looked mighty rough so I kept going, but I was again beginning to lose altitude rapidly when I sighted the Air Corps field at Fort Benjamin Harrison. Luck was with me, and I managed to make it in over the fence for a sloppy landing. The engine apparently loaded up, and it was all I could do to taxi to the apron.

After explaining my difficulties, a couple of Army mechanics volunteered to help, and we went to work on the engine. Everything we checked seemed okay—carburetor, plugs, wiring, valves, fuel line, strainers, all appeared to be in order and still no explanation for the trouble. At last we came to the conclusion that the spark plugs must be at fault. I bargained for a set out of another engine that was sitting in the shop and took off again—my fifth take-off in less than 150 miles. I had hardly leveled off until the engine repeated its discouraging performance, and it was then that I made my cardinal mistake. I thought "To —— with it. I'll make it or bust." It was only 15 miles to Indianapolis, and I argued that I could easily make that distance.

I had been so interested in getting the engine repaired that I had not even given the weather a thought, and before I knew it, I was in a heavy fog—with the engine running like a broken down Model T. I realized then that the air was much warmer and that the sudden temperature change must be responsible for the fog.

I was flying at 1,000 feet but the tach showed an irregular 900 r.p.m.'s, and I was losing altitude too rapidly for comfort. The fog had an occasional hole in it and I could glimpse the outskirts of Indianapolis at irregular intervals. I kept on, feeling that I could never make it back. By this time, the altimeter was showing 800 feet, and I began to realize the extent of my mistake. I could see myself as the center attraction in a very unpleasant picture, and there wasn't a thing that I could do about it but hope. The fog had closed in tight as I got nearer the river, and a feeling of panic began to drive all rational thoughts from my mind. I tried to keep the ship in a level attitude by using the compass float for a bank indicator, and the tach to avoid climbs and dives, but the harder I worked, the more I seemed to wallow around. I suddenly realized that I had a death grip on the stick, so I tried to relax and let the ship fly itself, but for one who had never done any blind flying this was easier said than done.

Visions of coming up solid against a tall building kept flitting through my mind, and I was almost to the point of giving up when a hole appeared in the fog and through that hole I saw the orange hangar of the Hoosier Airport—the most welcome sight that I have ever seen in my life. I made the field on the last of my wheezy motor and climbed weakly out to be told that a Lockheed *Vega* had been cruising around in the soup over the city for the last half hour waiting for a chance to come in. I sank to a bench and began to realize how much luck and how little sense I had.

The engine trouble turned out to be a crack in the high tension distributor pencil of the magneto that would open up and arc only after the engine was good and warm. The main trouble, however, was the "nut" that held the stick in place.

END

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The RCAF

(*Continued from page 44*)

From the nucleus of eight fields, the 72 completely equipped air centers have sprung into full being in just 24 months. The fields are lighted for night flying, have everything from barracks and reception rooms to control towers and hangars. They lack nothing essential to safe and thorough training.

"Night flying is particularly important, coupled with instrument work," he points out. "When Europe is blacked out under you, if you don't know your instruments, you might as well give up then and there. This isn't daytime warfare. No pilot is turned out today without a thorough knowledge of how to use his instruments."

It was thought that the Canadian winter, lasting from September to April, would bog down the Joint Air Training Plan. But Canadian spirit was such that construction was not for an instant halted at any of the new air centers. And, when it was thought that snows would prevent training flights, it was found that snow, if rolled, made an excellent runway with a surface that exerted an almost uncanny grip on tires. Winter training is more successful because of clearer skies.

In addition to the RCAF, the RAF is also operating schools in Canada. These are manned entirely by RAF personnel.

The speed with which Canada has built its air power startles even the Canadians. Only a year before, when the "Captains of the Clouds" company started filming at Uplands, there was little more than an open field. Today, there is a completely equipped school on the site—Service Flying Training School Number Two—and it is in full operation.

Aircraft have not only multiplied but have undergone some amazing changes. When the original equipment soon proved to be both obsolete and inadequate, it was necessary to start from scratch. The British agreed to send over some Avro *Anson* bomber trainers. This plan fizzled out due to transportation problems and the fact the *Ansons* were direly needed in Great Britain. On the other hand, the bomb and gunnery schools have been able to get Fairey *Battles*, two-place fighters which were unsuitable to modern combat fighting, due to many reasons including a bad blind spot.

Elementary training is now given on Fleet biplanes, built at Fort Erie, Ontario; De Havilland *Tiger Moths*, produced near Montreal and the new low-winged Fairchild 71's, which have been flowing steadily to the RCAF air centers for the past several months and are proving very satisfactory.

For pursuit pilots taking service training, the North American BT-17's, known as *Harvards*, are the backbone. Also used are BT-14's known as *Yales*. Many of these ships were obtained in a hurry when France went under. There was a huge French order and it was taken over by the RCAF. *Harvards* are equipped with retractable landing gear and also have been delivered in large numbers.

Cadets taking flight instruction on bombers at the service flying training schools now get most of their training on twin-motored Cessna *Cranes* and Avro *Ansons*.

Also used in the RCAF are a few Lockheed *Electras*, for communications, and Lockheed *Hudsons*, which are being used on both the Atlantic and Pacific coastal patrols.

The equipment used in the Joint Air Training Plan is such that, coupled with the excellence of the pilot material, the washout percentage is very low. Cathcart-Jones estimates that only 14 per cent are washed out in each of the three training stages. As of September 1, 1941, all 72 air centers were in full operation, and the present pilot output is estimated at 900 monthly, with the number steadily increasing. There are approximately 80 planes at each air center. The centers are devoted to elementary and service flying. There are bomb and gunnery schools and schools for air observers as well.

One of the highlights of Cathcart-Jones' experience as technical adviser for "Captains of the Clouds" occurred near Halifax. The wind-up of the picture calls for a Messerschmitt Me-109 to attack a group of unarmed bombers being flown across the Atlantic. No Me-109 was available, so arrangements were made by Cathcart-Jones to dress up a Hawker *Hurricane* which was available, to look like the German pursuit job. It was repainted, tricked up and huge iron crosses were painted on it.

Flight Lieutenant Russell, with 11 German victories to his credit, was assigned to fly the disguised plane for the scenes in the picture. Wanting to find out how it flew, Russell crawled into the cockpit and headed for Halifax, which is heavily armed with antiaircraft guns. He proceeded to put on a terrific show just over the housetops. RCAF personnel waited with trepidation for the batteries to cut loose at him.

When he landed, he was asked why he'd taken such a chance.

"They couldn't hit me over in Europe, so I just figured they couldn't hit me over here," Russell replied.

Cathcart-Jones thinks that this story really highlights the Canadian spirit.

END

Tailless Aircraft

(*Continued from page 45*)

designs in the air. The *Pigeon's* upturned, flexible wing tips later became the conventional ailerons. A sketch in Section 6 shows the plane, while the gliders are sketched in Section 5.

In 1918 W. Stout built the *Batwing* shown in Section 7. It had a small tail at its trailing edge. Driven by a 200 h.p. Packard engine it made many flights. The *Batwing* is noted as the first successful low aspect ratio airplane.

An all-wing airplane design put through a foreign patent office (French) by Penaud in 1876 is illustrated in Section 8. Penaud was the builder of the first rubber driven airplane model.

An all-wing airplane built by Ellehamer (Denmark) in 1901 is shown in Section 9. It had a circular, rotating wing. Later a propeller was added, and a flight was claimed but never proved.

In Section 10 is shown a design of the French Caudron airplane factory. Construction was started in 1938, but no more was heard about it. In Section 11 a very interesting and successful tailless airplane is sketched. It was designed in the United States by Waldo Waterman. He called it the *Arrowbile*. By dismantling the wings the fuselage could be used like an automobile driven by the rear wheels and steered by the front wheel.

A design shown in Section 12 is an unorthodox design. By opening or closing one or both surfaces placed above the wing, horizontal and lateral stability could be obtained.

A design that used the sweepback of the wings, the *Pterodactyl*, was built in England. This is sketched in Section 13.

In 1934 Fa.man (France) built and flew a low aspect ratio pictured in Section 14. Its top speed was 125 m.p.h.

An all-wing glider is the *Horta III* shown in Section 15. With a retractable landing gear, it had a sinking speed of 90 f.p.m. Another all-wing glider, sketched in Section 16, was built in Russia and had a straight trailing edge.

The *Uniplane*, built in Chicago, is

(*Continued on page 104*)

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INDUSTRY ITEMS

Tubin Seal-Cap, Inc., Los Angeles, Cal., has developed several new type plugs and caps for threaded aircraft tubing and other threaded parts for planes. The caps serve to eliminate danger of dust, dirt or moisture entering tubing while it is in shipment or storage. The protectors which are made of light metal, cannot damage threads. They protect flanges and tapered surfaces, the company claims and can be reused several times. The plugs and caps have been made in nine stock sizes ranging from one-quarter inch to one inch. Units are all cadmium plated.

A new arc welder which has a quick hot start particularly applicable to the welding of small gauge alloy parts in aircraft construction, has been developed by the Hobart Brothers Co., Troy, O. The welder has a low range welding current specified from 10 to 150 amperes at normal welding voltage. The machine, is especially adapted to welding voltage. The machine is especially adapted to welding chrome moly steel now used extensively in engine mounts.

The Stearman Aircraft Division of the Boeing Airplane Company has changed its name to Wichita Division Boeing Airplane Company, according to a recent announcement by P. G. Johnson, Boening president; and J. E. Schaefer, vice-president and general manager of the Wichita Division. The new name, it is said, reflects closer coordination between the Boeing plant in Seattle and the Wichita plant.

The DeVilbiss Company, Toledo, O., has developed a new four h.p. gasoline-engine-driven portable air compressing mechanism for the operation of a two-gun spray painting device. The new gun accessory has been found particularly efficient in the painting of airplanes. The company is also building a six h.p. portable air-compressing outfit.

The commercial engineering department of Westinghouse Electric and Manufacturing Company, Bloomfield, N. J., has developed a new "no-blink" starter switch which ends a fluorescent lamp's life when it has reached the stage where it blinks on and off. Designed specifically for the 40-watt Mazda fluorescent lamp, the new switch eliminates blinking and flickering of burned-out lamps.

A new series of aircraft drills has been announced by the Independent Pneumatic Tool Company of Chicago. Weighing less and developing approximately twice the power of ordinary, similarly rated, production-duty electric drills the U14F series of drills is most useful for operation in the limited space in plane construction work. Drills are available in three different speeds and have side switch handle for either continuous or intermittent drilling.

General Motors' new propeller division, Aeroproducts Corp., Dayton, O., is building a new type hydraulic airplane propeller for the Air Forces. The plant is working three shifts, six days a week. Five different models are manufactured.

Using a recently developed liquid plastic material, sprayed on sheet metal like lacquer or paint, the Westinghouse Meter Division, Newark, N. J., is producing white instrument dials reported not to discolor when exposed to high temperatures, light, chemical fumes, or moisture. The plastic is hardened by quick heating and baked in an electric oven. Dial faces are lithographed on the metal sheets after they are coated with the white plastic material. The smooth, hard plastic surface requires a special printing process in order to take the dial figures.

A new aviation spark plug designed especially for high altitude operations is being produced by General Motors Corporation's AC Spark Plug Division, Flint, Mich. The plug incorporates a new insulator material, next in hardness to the diamond. Severe tests at varying temperatures proved the new plug so efficient that it now is being used in U. S. warplane engines.

The B. F. Goodrich Company, Akron, O., has developed a self-sealing hose designed to make airplane fuel systems completely bulletproof. The new type hose will make the entire fuel systems on planes safe from enemy bullets and leakproof.

Designed to provide maximum control in minimum space, with the many unique needs of national defense in mind, Guardian Electric Manufacturing Co. has announced its new series 195 DC midget relay. Maximum contact capacity is approximately 150 watts, measured at 110 volt, 60 cycle, non-inductive AC. The manufacturer reports that in a number of present aircraft applications, the contacts on the new midget are making and breaking three non-inductive amperes at 28 volts DC. Maximum contact combination available is double pole, double throw.

The U.S. Galvanizing & Plating Equipment Corporation, Brooklyn, N. Y., in collaboration with Metallizing Engineering Co., Inc., of Long Island City, N. Y., has developed an automatic metallizing machine which eliminates the former hand-spraying operations on aircraft cylinders. The new device recently was installed by Pratt & Whitney, Wright Aeronautical, Buick, Studebaker and other large engine manufacturers for spraying of aluminum and similar corrosion-resistant metals on air-cooled cylinders.

THE LIBRARY

FIRST BLOOD FOR THE RAF
by Charles Gardner. 272 pp. Illustrated. David McKay Company, Washington Square, Philadelphia. $2.50.

The true story of the RAF in France. England's gallant heroes of the air who fought with the advanced RAF units over France during the months leading to the surrender of the French Army and the famous evacuation of Dunkirk.

Here is a gripping story of Britain's pilots who flew planes without armor, without self-sealing gasoline tanks, without heavy caliber guns, into the swarms of Nazi attackers who had all of these factors on their flying machines and whose planes outnumbered the RAF 10 to one.

The struggles of the RAF advanced units in France are told vividly in this book written by a young BBC radio correspondent who lived with the men of Britain's advanced air force in France. He tells how the pilots lived; how they died.

The suicidal bombing flight against the Maastricht Bridges; the surprise for the Nazi air fleet over Dunkirk; the full story of Great Britain's first air ace in this war, Cobber Kain, are told in vivid detail. The author also touches on subjects that deal with the propaganda or "leaflet" raids over Germany, the Fifth Columnists and the spy net in France, and the absence of French co-ordination between the British and French air units and antiaircraft units.

And Gardner predicts in his conclusion that England's air warriors shall have their revenge. He says: ". . . but, when the new striking force (RAF) goes out to conquor, when the new and better *Hurricanes, Battles, Blenheims,* or whatever their successors may be called, take the air, such of us who are still here will remember, with pride, the men who flew from the fields of France in 1940."

PICTURES FOR DEFENSE!

Who are the photographers helping train the public in civilian defense? Who portrays graphically such subjects as price control, priorities, industrial production and conservation? It's the Photographic Unit of the O.E.M.'s Division of Information. Read about these crack photographers, how they work on their vital job under terrific pressure, how they work out such problems as remote extension flashes set off by short-wave radio. It's told in the lively

APRIL ISSUE

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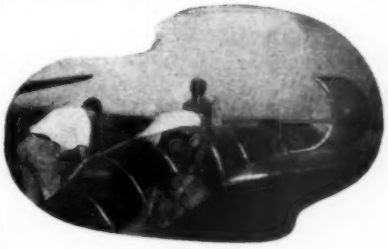

SOARING... for the Army

Gliding and soaring are now being taught selected flyers by the Army in schools offering intensive, 30-hour courses. Adoption of proper soaring techniques involves reversal of many habits drilled into these flyers through long hours of power plane flying. In soaring, the stick is pushed forward to climb; sailplanes are dived when landing; leveling off is delayed until the plane is inches off the ground, and the craft can be turned at a 360° angle when there's a scant 100 feet of altitude left! . . . Next month's FLYING brings you an Army officer's description of his experiences with these motorless planes that accomplish feats which, to power plane pilots, seem virtually impossible. It's told in the

MAY ISSUE

FLYING

ON SALE AT ALL NEWSSTANDS APRIL 10

(*Continued from page* 102)

shown in Section 17. Many flights indicated that the proximity of the propeller to the wing lessened the performances of this plane.

A design that claims the first power driven flight (France) is shown in Section 18. It has the outline of a bat, its propellers are driven by a steam engine. Ader, the designer, claimed a 900-foot flight on October 14, 1897. Like most of the single-flight planes it has no authentic or at least photographic proof of the occurrence.

The glider shown in Section 19 cannot be called a tailless glider even though the tail is close to the trailing edge.

The first successful tailless airplane is the Burgess-Dunne biplane built in this country in 1910. It is shown in a sketch in Section 20.

A French record breaker for altitude is the tailless airplane of Fauvel, shown in Section 21. It weighed 560 pounds. Driven by a 75 h.p. motor it had a top speed of 112 m.p.h.

The tailless airplanes shown in Section 22 and Section 23 made many flights but the performances did not surpass those of conventional airplanes. Therefore many designs never passed the drafting table. Such was the case with the project shown in Section 24.

In 1932 the *Arup*, shown in Section 25, made its first flight in South Bend, Ind. Its longitudinal stability was questionable and a tail was added as shown in Section 26. Its maneuverability was thereby greatly improved.

The *Man-O-War* or frigate bird shown in Section 27 may give the aeronautical engineer a few pointers for designing an all-wing airplane. In Section 32 the working of the primary or wing tip feathers is shown. They are open when the air comes below, and close when the stream is from above, thus giving the same lifting forces.

The latest and perhaps the only all-wing airplane is the one built by Northrop. A sketch shown in Section 28 is taken from published photographs. It has two 120 h.p. motors driving propellers at the ends of 10-foot shafts.

Two wind tunnel results are noted in Section 29 and Section 30, one for a high aspect ratio wing and the other for a low aspect ratio. The wind tunnel results of the Fauvel plane shown in Section 21 are given in Section 31.

The future development trend of the tailless airplane should be towards an all-wing plane. New, thicker airfoil sections must be found; the stability factor must be evaluated by building a few experimental wings. The question of low or high aspect ratio again will arise. The amount of dihedral and cahedral (negative dihedral) sweep-back must be determined, for they will replace all control surfaces. The whole wing must in itself be aerodynamically stable. This presents a problem not easily solved.

END

Mass-Production

(*Continued from page* 38)

Soviet Union. But in Norway as in Crete, even in the battles of the Mediterranean and the North Atlantic, land based aircraft were the dominant factor.

The entry of Japan into the war changed all that. The attack on Pearl Harbor opened not only a new theater of war, but also a new phase in which navies and naval air power have the preponderant interest. Despite the operations in Malaya and the land attack on Luzon, the war in the Pacific is a naval war. Land operations, to be sure, are the ultimate purpose of the opposing notions but without initial and continuously supporting action of naval forces cannot be maintained. Since the treacherous dawn attack of December 7, the emphasis as never before has been on aircraft carriers.

This does not mean that land-based aircraft will play a secondary role. The survivors of the *Repulse* and *Prince of Wales* can testify as to that, while the operations of our own *Flying Fortresses* are continually extending the scope and range of air-borne destruction out over the waters of the southwestern Pacific. But for operations in the hundreds of islands large and small scattered from India to the international date line, and for convoying the scores of transports and cargo vessels with which we must almost literally infest that area before the victory can be won, aircraft carriers are destined to play a vital part.

This new phase has not been entirely unexpected. Included in the plans for our two-ocean navy are additional aircraft carriers for the Fleet. More recently, efforts have been directed toward converting commercial ships of various types since the demand is so pressing and the large vessels designed for operations with battle squadrons obviously cannot be completed for many months. Converting an oil tanker or a passenger vessel into an aircraft carrier is not the easiest problem in the world to solve, as our experience with the *Langley* has shown. At least 100 designs are on file in the Patent Office dealing in general with the question of landing an airplane on a ship's deck, many of them with the particularly difficult problem of converting commercial vessels to this use.

While the Navy Department is proceeding with all possible speed on its conversion program along conventional lines, the Quinn invention is causing considerable comment in Washington. About half the Naval experts who have looked it over are in favor of giving it a trial. Of the remainder, some are doubtful and others definitely opposed, firmly convinced it will not work. However, the interesting part of this difference of opinion, so characteristic of attitudes on almost any new development you might name, is that most of those who favor giving this new device a trial have had convoy experience.

It is not revealing any Naval secret, since the Germans already know it, to say that one of the most effective counter measures against German submarines in the Battle of the Atlantic has been the use of fighter craft, mostly Hawker *Hurricanes*, launched from merchantmen by catapult. Powered with a Rolls-Royce liquid-cooled Merlin motor, they are in the air as soon as enemy bombers are heard or known to be in the vicinity and with their rapid rate of climb can gain sufficient height in time to assure interception of the Focke-Wulf four-motored *Kurriers* usually used by the Germans for bombing convoys.

With their eight machine guns, the *Hurricanes* usually are capable of handling even a small formation of enemy bombers. Their greatest drawback is limited range. They carry only enough gasoline for 75 minutes flying at full throttle; cruising at 200 m.p.h. or less might extend their range to as much as 800 miles. But after an aerial com-

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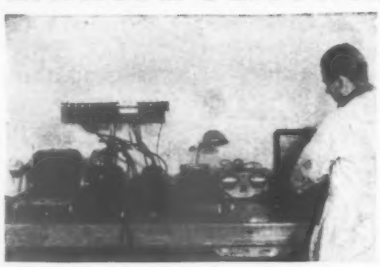

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bat, the pilots rarely have enough gasoline left to save the plane unless the convoy is within a short distance of the British Isles, Greenland or Iceland.

Obviously, we need more aircraft carriers. We need them as soon as we can get them. Obviously, too, the first thing to do is to carry out plans for the conversion of commercial vessels along well proven lines. Meanwhile, we should be looking around for new methods. If this new invention should prove to be a practicable way of enabling a pilot to land his craft safely after completing a mission, it would be a tremendous aid in the battles now being waged in both the Atlantic and Pacific areas.

Pending Naval action on his invention, Quinn frankly admits he does not know whether his device will, in practise, prove itself all that it promises in theory. He believes it will. If it does reach the trial stage he has one request to make:

"I can't build one of these landing decks myself. But if the Navy thinks it worth a trial, I would like to make the first landing."

END

Bug Hunters

(*Continued from page* 36)

preserve the insects in as good condition as possible. This adhesive is made up of a saturated solution of castor oil and resin. If the adhesive is not thin enough and is not spread over the surface properly, the air will not pass through the mesh, and many of the insects will be carried over or under the exposed screen.

The density of the daytime insect population of the troposphere varies. At 20 feet you'll find one of these denizens of the air every 15 feet in all directions. At 1,000 feet they drop to one every 25 feet, also in all directions. At 5,000 feet, there's almost wing room, with one insect, mite or spider, every 49 feet. However, during the flights of termites, or nuptial flights of ants and bees, things are a bit on the crowded side.

More insects are collected during the day than at night. There are only 12 recognizable specimens of insects taken at night compared to 20 taken in day flights. Of the total insects taken during the Louisiana air rides, some 30,000 species of 216 known families were represented, in addition to 24 new species.

In the airplane flights at Tallulah, it was found that the greatest number of insects were taken when the surface wind direction was from the north, northeast, southeast, or southwest. Some insects, apparently, were moving with the wind during the spring and summer when the surface prevailing winds were from a southerly direction, and again with the wind from a northerly direction in the fall.

Another peculiarity of air-minded insects lies in the fact that they seem to enjoy moonlight. A larger catch was made during flights conducted by moonlight than on very dark nights.

While the airways are definitely crowded the first 1,000 feet from the ground, at 2,000 feet there are only half

(*Continued on page* 113)

FLYING'S USED PLANE LISTING OF AUTHORIZED AIRCRAFT DEALERS

The world's largest selection of used aircraft is listed in this special reader service section. Fine used airplanes in good licensed condition, some with hardly any time at all, many with but a few hours since overhaul. Each plane selected by an expert who has the mark of factory approval due to the fact he is an AUTHORIZED AIRCRAFT DEALER. These are ships you can buy to fly. Select any one of them, they are all real buys, and can be purchased just as you purchase your car.

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DEALERS	MODEL AND ENGINE	TIME	TIME SINCE OVER-HAUL	PRICE
AERONCA				
Cedar Rapids Airways, Inc., Box 183, Cedar Rapids, Iowa	Chief Lyc. 65	360 hr.	Never	$1895
Elmer Westerlund, Jackson, Mich	65 CA DeLuxe Cont.	180 hr.	Never	1800
United Aero Corp., Box 222, San Antonio, Texas	Defender Frnkln. 65	160 hr.	160 hr.	1650
Knolle Flying Service, Box 1157, Alice, Texas	Chief Lyc. 65	500 hr.	None	1600
Cliff Ryan, Box 82, Muscatine, Ia	Chief Lyc. 65	500 hr.	50 hr.	1550
Plow City Fly. Serv., Munic. Arpt., Moline, Ill.	Chief Cont. 65	220 hr.		1450
Morristown Fly. Club, Morristown, Tenn	Chief '40 Lyc. 65	362 hr.	No	1375
Northern Air Serv., Arpt., Grand Rapids, Mich.	Low Wing Ken Royce 90	550 hr.	50 hr.	1350
Northern Air Service, Grand Rapids, Mich.	LB Ken Royce 90	550 hr.	100 hr.	1350
O. E. Dickerhof, Munic. Arpt., Chanute, Kans.	1941 Lyc. 65	150 hr.	Never	1300
Lane Air Service, Albany, Ga	Chief DeLuxe Cont. 65	375 hr.	Recently	1300
Inter-City Avia. Inc., Boston Munic. Arpt., E. Boston, Mass	Chief Lyc. 65	825 hr.	210 hr.	1250
Pierce Flying Service, Box 894, Eureka, Calif.	Chief Cont. 65	2038 hr.	49 hr.	1250
Jacksonville Air Service. 33 East Second St., Jacksonville, Fla	Chief Cont. 65	400 hr.	Just	1200
Tred Avon Flying Service, Easton, Maryland	Trainer Frnkln. 65	397 hr.	Never	1195
St. Louis Fly. Serv., Lambert Field, Robertson, Mo	KCA Cont. 50		Recently	1175
Jenkins Air Serv., Munic. Arpt., Rochester, N. Y.	Trainer Lyc. 65	550 hr.	50 hr.	1150
Blvd. Arpt., Inc., Roosevelt Blvd., Phila., Pa.	TL Lyc. 65	150 hr.	No	1150
Jenkins Air Serv., Inc., Munic. Arpt., Rochester, N. Y.	TL Lyc. 65	200 hr.		1150
Springfield Avia. Co., Munic. Arpt., Springfield, Illinois	Tandem Tr. Frnkln. 60	303 hr.	No	1150
Tred Avon Flying Service, Easton, Maryland	Trainer Lyc. 55	403 hr.	Never	1145
Max Conrad, Conrad Arpt., Winona, Minn.	Trainer Lyc. 50	393 hr.	None	1100
Evan Holtzman, Royal Airport, Madison, Wisc.	TL Lyc. 65 dual	419 hr.	39 hr.	1100
Art Whitaker, Swan Island Arpt., Portland, Oregon	Trainer Lyc. 65	700 hr.	500 hr.	1075
Dakota Aviation Company, W. W. Howes, Municipal Airport, Huron, S. Dak	C-50 Cont. 50	650 hr.	Top	1050
United Aero Corp., Box 222, San Antonio, Texas	Trainer Lyc. 65	960 hr.	Just	1000
Evan Holtzman, Royal Airport, Madison, Wisc.	T Lyc. 65 dual	423 hr.	33 hr.	995
Dakota Aviation Company, W. W. Howes, Municipal Airport, Huron, S. Dak	LA Lyc. 50	1650 hr.	220 hr.	975
Tred Avon Flying Service, Easton, Maryland	Trainer Lyc. 50	532 hr.	Just	960
Midwest Flyers, Lakeside Arpt., E. St. Louis, Ill.	Trainer Frnkln. 60	550 hr.	Jan. '41	950
Evan Holtzman, Royal Airport, Madison, Wisc.	TL Lyc. 65	419 hr.	37 hr.	900
Knolle Flying Service, Box 1157, Alice, Tex.	Chief Cont. 50	800 hr.	20 hr.	900
Albert E. Padags, Tri-City Airport, Wisconsin Rapids, Wisc	Chief '39 Cont. 65	1120 hr.	20 hr.	900
Roy E. Taylor, Meacham Field, Fort Worth, Texas	Trainer Cont. 65	500 hr.	50 hr.	900
Knolle Fying Service, Box 1157, Alice, Texas	Frnkln. 60	985 hr.	None	875
United Aero Corp., Box 222, San Antonio, Texas	Trainer Frnkln. 60	1675 hr.	Just	875
Boulevard Airport Inc., Roosevelt Blvd. and Red Lion Road, Philadelphia, Penn	Tandem Lyc. 55	460 hr.	None	850
Tri-State Aviation Corp., Cincinnati Airport, Sharonville, Ohio	Frnkln. 50	795 hr.	Will Mjr.	850
O. E. Dickerhof, Munic. Arpt., Chanute, Kans.	C-50 Cont. 50	1200 hr.	200 hr.	775
O. E. Dickerhof, Munic. Arpt., Chanute, Kans.	1939 Cont. 50	850 hr.	150 hr.	775
Howard G. Mayes, Box 2104, Huntington, West Va	Trainer Cont. 50	1089 hr.	208 hr.	700
Cedar Rapids Airways, Inc., Box 183, Cedar Rapids, Iowa	K Cont. 40	325 hr.	Just	650
Pierce Flying Service, Box 894, Eureka, Calif.	C3 Aero 36	1452 hr.	43 hr.	550
A. F. Schachterle, Perkiomen Valley Airport, Collegeville, Penn	K E-113C	200 hr.	7 hr.	525
Aviation Market, L.A. Metropolitan Airport, Van Nuys, Calif	K 40	515 hr.	10 hr.	525
A. F. Schachterle, Perkiomen Valley Airport, Collegeville, Pa	K Aero 40	190 hr.	6 hr.	525
Hylan Flying Service, Inc., Rochester Airport, Rochester, N. Y	E 113C	1197 hr.	32 hr.	500
Howard G. Mayes, Box 2104, Huntington, West Va	C2 Aero 40	202 hr.	8 hr.	500
AMERICAN EAGLE				
John Ruzicka, Circus City Airport, Peru, Indiana	Kinner 100	330 hr.	30 hr.	600

DEALERS	MODEL AND ENGINE	TIME	TIME SINCE OVER-HAUL	PRICE
ARROW SPORT				
Hobley-Maynard Air Service, New Orleans Airport, New Orleans, La	Ford V8	600 hr.	Just	$ 500
BEECHCRAFT				
DuBois Aviation Association, Municipal Airport, DuBois, Pa	B-17-L Jacobs 225	293 hr.	Just	4250
Marian Parkinson, Estherville, Iowa	B-17-L Jacobs 225	879 hr.	25 hr.	3600
Pavey Flying Service, Box 195, Dawson, Okla.	B-17-L Jacobs 225	900 hr.	113 hr.	3500
BUHL				
Aircraft Sales of Michigan, Municipal Airport, Detroit, Michigan	Wright J-6-9 330	1100 hr.	Just	1650
CESSNA				
Duane L. Huscher, Box 65, Lawton, Okla	C-37 Warner 145	445 hr.	48 hr.	4000
CULVER				
Alabama Air Service, Auburn-Opelika Airport, Auburn, Alabama	Cadet Frnkln. 80	110 hr.	Never	2500
Galbraith Air Service, Municipal Airport, Paducah, Kentucky	LFA Frnkln. 80	29 hr.	New	2495
Gaare Aviation Corp., 1285 Cleveland Avenue N, St. Paul, Minnesota	LFA Frnkln. 80	41 hr.	Never	1995
Tri-State Aviation Corp., Cincinnati Airport, Sharonville, Ohio	Cadet Cont. 75	95 hr.		1950
Bishop Flying Service, Bishop Airport, Flint, Michigan	Cadet LFA Frnkln. 80	180 hr.		1900
Bishop Flying Service, Inc., Bishop Airport, Flint, Michigan	Cadet LCA Cont. 75	20 hr.		1800
Plow City Flying Service, Municipal Airport, Moline, Ill	Cadet Cont. 75	170 hr.		1750
Bishop Flying Service, Bishop Airport, Flint, Michigan	Cadet LCA Cont. 75	245 hr.		1600
CURTISS ROBIN				
Safair, Inc., Roosevelt Field, Mineola, New York	Chall. 185	1456 hr.	20 hr.	750
Red Bank Airport, Inc., Red Bank, N. J.	Chall. 185	575 hr.	162 hr.	650
DAVIS				
Arthur J. Davis, Box 446, East Lansing, Mich.	D-1-W Warner 125	137 hr.	None	1400
Capt. Arthur J. Davis, 1108 Civic Opera Building, Chicago, Ill	Warner 15	137 hr.	None	900
ERCOUPE				
Parkersburg Flying Service, Parkersburg, Va.	Cont. 65	300 hr.		2100
Aviation Market, L.A. Metropolitan Airport, Van Nuys, California	Cont. 65	145 hr.	Never	1950
FAIRCHILD				
W. Arnet Speer, 2830 Pacific, San Diego, Calif	F45 Wright 320	500 hr.	25 since major	10000
Piedmont Aviation, Inc., Municipal Airport, Winston-Salem, N. C	24 Warner 145	162 hr.	None	6985
Northway Flying Service, Norton Field, Columbus, Ohio	Warner 145	290 hr.	200 hr.	6500
Hyannis Airport Corp., Box 592, Hyannis, Mass	24 Warner 145	510 hr.	70 hr.	6000
Northern Air Service, Airport, Grand Rapids, Michigan	24G Warner 145	216 hr.	Never	4150
Thomas Metcalf, Toledo Mun. Arpt., Toledo, O.	24 Warner 145	356 hr.	Topped 306 hr.	3975
Air Activities, Inc., Munic. Arpt., Houston, Tex.	24 Warner 125	700 hr.	300 hr.	3750
T. A. Colbertson, Medford, Oregon	246 Warner 145	800 hr.	350 hr.	3500
T. A. Colbertson, Airport, Medford, Oregon.	246 Warner 145	1000 hr.	225 hr.	3250
Susquehanna Air Service, 439 Broad Street, Montourville, Pa	24 Ranger 145	850 hr.	180 hr.	2950

FLYING'S USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	TIME SINCE OVER-HAUL	PRICE
Cutter-Carr Flying Service, West Mesa Airport, Albuquerque, N. M.	24	Warner 145	900 hr.	100 hr.	$2500
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	24	Warner 145	350 hr.	Just	2395
Cutter-Carr Flying Service, West Mesa Airport, Albuquerque, N. M.	24	Warner 125	848 hr.	645 hr.	1400
Art Whitaker, Box 3820, Portland, Ore.	24	Cirrus 100	1200 hr.	None since Major	1125
Hylan Flying Service, Inc., Rochester Airport, Rochester, New York	21	Kinner 125	668 hr.	35 hr.	1000
Flying Dutchman Air Service, Somerton Airport, Philadelphia, Pa.	KR-34	Wright 175		12 hr.	925
FLEET					
Mount Hawley Flying Service, Box 626, Peoria, Ill.	8	Kinner B5	1622 hr.	None	1675
Alfred Bonnin, 109 W. Cleveland St., Spring Valley, Illinois	8	E70	140 hr.	18 hr.	1200
Brinckerhoff Flying Service, College Park Airport, College Park, Maryland	Mod. 1	Warner 125	793 hr.	55 hr.	1150
Tri-State Aviation Corp., Cincinnati Airport, Sharonville, Ohio	70		92 hr.		1150
White Fly. Serv., Inc., Caldwell-Wright Arpt., Caldwell, N. J.		Warner 125	1090 hr.	6/40	1095
HOWARD					
Des Moines Flying Service, Inc., Municipal Airport, Des Moines, Iowa	DGA-18		1100 hr.	165 hr.	3950
INTERSTATE					
Detroit School of Aviation, Inc., Jay Airport, Fraser, Michigan	'41	Cont. 65	112 hr.	Never	1975
KARI-KEEN					
Dakota Aviation Co., W. W. Howes, Municipal Airport, Huron, S. Dak.		Lambert 90	493 hr.	146 hr.	650
LUSCOMBE					
Aircraft Unlimited, Roosevelt Field, Mineola, N. Y.		Cont. 75	100 hr.	Never	2500
Aircraft Unlimited, Roosevelt Field, Mineola, L. I., N. Y.	8C1	Cont. 75	120 hr.	Never	2500
Albert E. Padags, Tri-City Airport, Wisconsin Rapids, Wisconsin	8C	Cont. 75	460 hr.	32 hr.	2150
Albert E. Padags, Tri-City Airport, Wisconsin Rapids, Wisconsin	Silvaire 8C	Cont. 75	420 hr.	41 hr.	2100
Air Serv., Inc., Mun. Arpt., Denver, Colo.	8A	Cont. 65	54 hr.		1850
Midwest Fly. Serv., La Grange, Ill.	8A	Cont. 65-Dual	125 hr.	None	1850
Tri-State Aviation Corp., Sharonville, Ohio		Cont. 65	245 hr.		1750
Massey and Ransom Flying Serv., Inc., P.O. Box 416, Ft. Collins, Colo.	8A	Cont. 65	1139 hr.	175 hr.	1495
Albert E. Padags, Tri-City Airport, Wisconsin Rapids, Wisconsin	8A	Cont. 65	580 hr.	175 hr.	1200
Albert E. Padags, Tri-City Airport, Wisconsin Rapids, Wisconsin	8A	Cont. 65	450 hr.	150 hr.	1200
Aircraft Unlimited, Inc., Roosevelt Field, Mineola, N. Y.		Cont. 75			550
MEYERS					
Lynchburg Air Transport & Sales Corp., Preston Glenn Airport, Lynchburg, Va.	OTW	Warner 125	475 hr.	Just	4000
NEW STANDARD					
Spooner Air Serv., Box 552, Claremont, N. H.	D-25	Wright J5 220	767 hr.	525 hr.	1200
Boulevard Arpt., Inc., Roosevelt Boulevard, Philadelphia, Pa.		Kinner 90	1500 hr.	700 hr.	700
PIPER CUB					
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	J4	Cont. 65 '40	70 hr.	None	2200
W. Arnet Speer, 2830 Pacific, San Diego, Calif.	Cruiser	Cont. 75	286 hr.	Never	2850
E. P. Jacoby, Sterling Airport, Sterling, Ill.	Cruiser J5A	Cont. 75	20 hr.	Never	2200
John Ruzicka, Circus City Airport, Peru, Ind.	Cruiser	Cont. 75	24 hr.	None	2000
Pierce Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.		Cont. 75	181 hr.	Never	1965
Southern Vermont Flying Service, Airport, N. Springfield, Vt.	Cruiser	Cont. 75	60 hr.	New	1900
Stiles Motor Co., 260 Main St., Northport, N.Y.	Coupe J4A	Cont. 65	142 hr.	New	1900
Piedmont Aviation, Municipal Airport, Winston-Salem, N. C.	Coupe	Cont. 65	86 hr.	None	1885
Piedmont Aviation, Inc., P.O. Box 1941, Winston-Salem, N. C.	Coupe	Cont. 65-Dual	46 hr.	Never	1885
John Ruzicka, Circus City Airport, Peru, Ind.	Cruiser	Cont. 75	26 hr.	Never	1875
L. L. Rupert, Box 446, Muskogee, Okla.	Coupe '40	Cont. 65-Dual	155 hr.		1850

DEALERS	MODEL AND ENGINE		TIME	TIME SINCE OVER-HAUL	PRICE
McBoyle Cub Sales, Airport, Lake Delton, Wis.	Cruiser	Lyc. 75	61 hr.	New	$1845
McBoyle Cub Sales, Lake Delton, Wisconsin	Cruiser	Lyc. 75	40 hr.		1800
Marlboro Airport, Inc., Farm Road, Marlboro, Mass.	Cruiser J-5	Cont. 75	196 hr.	Never	1800
Elliott Flying Service, Clinton County Airport, DeWitt, Ia.	Cruiser	Cont. 75	75 hr.	Never	1800
McBoyle Cub Sales, Airport, Lake Delton, Wis.	Cruiser	Lyc. 75	64 hr.	New	1795
Southern Vt. Fly. Serv., Arpt., N. Springfield, Vt.	Cruiser	Cont. 75	40 hr.	New	1750
Northway Flying Service, Norton Field, Columbus, Ohio	Cruiser	Cont. 75	300 hr.	300 hr.	1700
Max Conrad, Conrad Airport, Winona, Minn.	Cruiser	Cont. 75	866 hr.	None	1600
Rannell's Air Service, Inc., Airport, Cumberland, Md.	Cruiser J5	Lyc. 75	80 hr.	Never	1600
Zimmerly Brothers Air Transport, Box 266, Lewiston, Idaho	Cruiser	Cont. 75	485 hr.		1600
Fred Helm, Helms Airport, Zap, N. Dak.	J-5 Cruiser	Cont. 75	95 hr.	Never	1600
Rocky Mount Flying Service, Municipal Airport, Rocky Mount, N. C.	Cruiser J5	Cont. 75	240 hr.	None	1600
Herman L. Martin, Munic. Arpt., Walla Walla, Wash.	J4	Cont. 65	450 hr.	25 hr.	1600
Skelly's Flying Service, Greenville Airport, Greenville, Pa.	J6-C-75	Cont. 75	100 hr.	Never	1595
DuBois Aviation Association, Municipal Airport, DuBois, Pa.		Cont. 65	97 hr.		1595
Paul D. Eyster, Tri-State Airport, Angola, Indiana	J-5	Cont. 75	210 hr.	None	1590
Paris Flying Service, Municipal Airport, Paris, Texas	J-4A	Cont. 65	150 hr.	Never	1575
Racine Fly. Serv., Racine Arpt., Racine, Wisc.	J-4	Cont. 65	383 hr.	353 hr.	1575
J. E. Badger, 1780 Green Road, S. Euclid, O.	Coupe '40	Cont. 65	125 hr.		1550
Southern Air Service, Memphis, Tenn.		Cont. 65	100 hr.	New	1550
Williams-Blood Aircraft Sales, Inc., Box 1212, Charleston, W. Va.	J3	Frnkln. 65	60 hr.	Never	1500
J. E. Badger, 1780 Green Rd., S. Euclid, Ohio	Coupe	Cont. 65	125 hr.	None	1500
E. H. Brockenbrough, Mun. Arpt., Charlotte, N. C.	J4 '40	Cont. 65	200 hr.	200 hr.	1500
Racine Fly. Serv., Racine Arpt., Racine, Wis	J-4	Lyc. 63	330 hr.	Top 320	1475
Des Moines Flying Service, Inc., Municipal Airport, Des Moines, Iowa	Coupe '40	Cont. 65	192 hr.	None	1450
Gillis Flying Service, Box 1806, Great Falls, Montana	Coupe	Cont. 65	900 hr.	15 hr.	1450
Des Moines Flying Service, Inc., Municipal Airport, Des Moines, Ia.	Trainer	Frnkln. 65	200 hr.	None	1450
Richard F. Holladay, Box 147, Fredericksburg, Va.	Cruiser	Cont.	400 hr.		1450
Maheux's Airport, Inc., Stevens Mill Road, Auburn, Maine	J-3	Frnkln. 65	75 hr.	Never	1400
McBoyle Cub Sales, Lake Delton, Wisc.	Trainer	Lyc. 65	20 hr.		1400
Northway Flying Service, Norton Field, Columbus, Ohio	J-3	Frnkln. 65	100 hr.	100 hr.	1400
Williams-Blood Aircraft Sales, Inc., Box 1212, Charleston, W. Va.	J-3	Lyc. 65	200 hr.	Never	1400
Lexington Fly. Serv., Munic. Arpt, Lexington, Kentucky	J-5	Cont. 75	230 hr.		1400
Reliable Fly. Serv., P.O. Box 1303, Bristol, Conn.	J-4	Cont. 65	140 hr.	30 hr. fact.maj.	1400
Philadelphia Skyport, Inc., 4507 Marvine Ave., Drexel Hill, Pa.	Seaplane	Cont. 65	970 hr.	225 hr.	1390
J. L. Schroeder, Inc., Box 8055, Houston, Tex.	J-3	Frnkln. 65	142 hr.	None	1375
Bay State Flying Service, Framingham Airport, Framingham, Mass.	J-3	Lyc. 65	15 hr.	Never	1350
Harold W. Grucky, 1326 Walnut Street, Newton Highland, Mass.	J-3 Trainer	Lyc. 65	175 hr.	Never	1350
Roy R. Taylor, Meacham Field, Fort Worth, Texas	Cruiser	Cont. 75	550 hr.	75 hr.	1350
Desjardin Air Service, 118 Heywood Street, Worcester, Mass.	J-3	Lyc. 65	400 hr.	Never	1350
Southern Vt. Fly. Serv., Arpt., Springfield, Vt.	J-3L '40	Lyc. 65	162 hr.	New	1350
William-Blood Aircraft Sales, Inc., Box 1212, Charleston, W. Va.	J-3	Lyc. 65	200 hr.	Never	1300
TriCities Avia. Sch., TriCities Arpt., Endicott, N. Y.	J-4 '39	Cont. 65	500 hr.		1300
Williams-Blood Aircraft Sales, Inc., Box 1212, Charleston, W. Va.	J-4	Cont. 65	350 hr.	150 hr.	1295
Aviation Market, L.A. Metropolitan Airport, Van Nuys, Calif.	Cruiser	Cont. 75	110 hr.	Never	1275
Des Moines Flying Service, Inc., Municipal Airport, Des Moines, Ia.	Trainer J-3	Frnkln. 65	257 hr.	None	1250
Bay State Flying Service, Framingham Airport, Framingham, Mass.	J-3	Lyc. 65	130 hr.	Never	1250
Southern Vt. Fly. Serv., Arpt., N. Springfield, Vt.	J-3L '40	Lyc. 65	280 hr.	New	1250
Madison Fly. Serv. R. I., Madison, Ind.	J-3L	Lyc. 65	205 hr.	No	1235
Richard F. Holladay, Box 147, Fredericksburg, Va.	Trainer	Frnkln. 65	369 hr.		1200
Mangen F. Warrington, Cub Fly. Serv., Selbyville, Del.	J-3 '39	Cont. 55	40 hr.	No	1200
Desjadirn Auto Serv., 24 Fairmount Ave., Worcester, Mass.	Dual J-4	Cont. 65	550 hr.	400 hr.	1200
Gillis Flying Service, Box 1806, Great Falls, Mont.	J-3	Cont. 65	500 hr.	None	1200
Williams-Blood Aircraft Sales, Inc., Box 1212, Charleston, W. Va.	J-4	Cont. 65	300 hr.	100 hr.	1195
Galbraith Air Serv., Munic. Arpt., Paducah, Ky.	J-3L	Lyc. 65	102 hr.	No	1195
Philadelphia Skyport, Inc., 4507 Marvine Ave., Drexel Hill, Pa.	J-3	Cont. 65	455 hr.	202 hr.	1190

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE	TIME	TIME SINCE OVER-HAUL	PRICE
Paul D. Eyster, Tri-State Airport, Angola, Ind.	J-3 Frnkln. 65	250 hr.	New	$1125
Northway Flying Service, Norton Field, Columbus, Ohio	J-3 Frnkln. 65	600 hr.	25 hr.	1100
Southern Vermont Flying Service, Airport, N. Springfield, Vt	J-3 Lyc. 65	525 hr.	Never	1100
Northern Air Service, Airport, Grand Rapids, Michigan	J-3 Lyc. 65	710 hr.	35 hr.	1100
Jesse Jones Air Service, Lancaster Municipal Airport, Lancaster, Pa	Trainer Frnkln. 65	240 hr.	Never	1100
Aviation Serv., Inc., Box 408, Newport News, Va	J-3 Lyc. 65	528 hr.	None	1100
McInnis Aviation Service, Inc., So. St. Paul Airport, So. St. Paul, Minn	J-3 Lyc. 65	1124 hr.	166 hr.	1075
Northern Air Service, Grand Rapids Airport, Grand Rapids, Mich	J-3 Lyc. 65	800 hr.	15 hr.	1050
Des Moines Flying Serv., Municipal Arpt., Des Moines, Ia	J-3 Frnkln. 65	500 hr.	None	1050
Gerald Gallagher, 4507 Marvine Ave., Drexel Hill, Pa	J-3 Cont. 65	720 hr.	95 hr.	1050
J. L. Schroeder, Inc., Houston Main St. Arpt., Houston, Texas	J-3 Cont. 65	596 hr.	Yes	1050
Gillis Flying Service, Box 1806, Great Falls, Montana	J-3 Cont. 65	900 hr.	300 hr.	1000
Safair, Inc., Roosevelt Field, Mineola, N. Y.	J-3 Lyc. 65	885 hr.	2 hr.	1000
Safair, Inc., Roosevelt Field, Mineola, N. Y.	J-3 Frnkln. 60	510 hr.	Never	1000
Pierce Flying Service, Municipal Airport, Ft. Wayne, Ind	J-3 Cont. 65	781 hr.	83 hr.	1000
Cedar Rapids Airways, Inc., Cedar Rapids, Ia.	J Lyc. 65	650 hr.	100 hr.	1000
Zimmerly Brothers Air Transport, Box 266, Lewiston, Idaho	Cont. 50	1300 hr.	90 hr.	1000
Spann Fly. Serv., Mun. Arpt., Colorado Springs, Colo	J-4 Cont. 65	650 hr.	200 hr.	1000
Richmond Air Trans., Byrd Arpt., Richmond, Va.	J-3 Frnkln. 60	530 hr.	215 hr.	1000
Stillwater Fly. Serv., Box 466, Stillwater, Okla.	J-3 Cont. A-505	1073 hr.	N'w eng.	1000
L. L. Rupert, Box 446, Muskogee, Okla	J-3 '40 Frnkln. 50	150 hr.	Like new	1000
Maheux's Airport, Inc., Stevens Mill Road, Auburn, Maine	J-3 Frnkln. 65	875 hr.	Never	995
Howard W. Grucky, 1326 Walnut Street, Newton Highlands, Mass	J-3 Lyc. 55	600 hr.	Just	995
Ben C. Arquitt, Mun. Arpt., Lima, Ohio	J-3 Frnkln. 60	314 hr.	272 hr.	970
Northway Flying Service, Norton Field, Columbus, Ohio	J-3 Frnkln. 65	1000 hr.	350 hr.	950
Susquehanna Air Service, 439 Broad Street, Montoursville, Pa	J-3 Lyc. 65	335 hr.	None	950
Leonard J. Schrader, Nauvoo, Ill	J-3 Frnkln. 60	487 hr.	Never	950
W. Arnet Speer, 3330 Barnett, San Diego, Calif	J-3 Cont. 50	1950 hr.	2 hr.	950
Ray Wilson, Inc., Park Hill Arpt., Denver, Colo.	J-3 Frnkln. 50	850 hr.	Mjr. 750 hrs.	950
McInnis Aviation Service, Inc., So. St. Paul Airport, So. St. Paul, Minnesota	J-3 Lyc. 65	1218 hr.	25 hr.	949
G. L. Williams, Syracuse Arpt., Syracuse, N. Y.	J-3 Frnkln. 60	998 hr.	Recent	925
T. A. Culbertson, Airport, Medford, Oregon	J-3 Frnkln. 50	1200 hr.	125 hr.	900
Desjardin Air Service, 118 Heywood, Worcester, Mass	J-3 Lyc. 55	1200 hr.	400 hr.	900
Hanover Air Service, Hanover Airport, East Hanover, N. J	J-3 Lyc. 55	5 hr.	Never	900
Skelly's Flying Service, Greenville Airport, Greenville, Pa	J-3 Lyc. 65	800 hr.	Just	900
Russ Walling, Walling-Watertown Arpt., Watertown, N. Y	J-3 Frnkln. 50	925 hr.	500 hr.	900
Consolidated Air Serv., Rubinkam Arpt., Harvey, Illinois	J-3 Frnkln. 60	720 hr.	None	900
Desjardin Auto Serv., 24 Fairmount Ave., Worcester, Mass	J-3 Lyc. 55	900 hr.	700 hr.	900
Southern Air Serv., Memphis, Tenn	Lyc. 50	300 hr.	New	900
Piedmont Aviation, Inc., Box 1941, Winston-Salem, N. C	Trainer Lyc. 65-Dual	842 hr.	348 hr.	$895
White Fly. Serv., Inc., Caldwell Wright Arpt., Caldwell, N. J	J-3 Lyc. 50	1201 hr.	1/41 hr.	875
Lexington Fly. Serv., Inc., Lexington Arpt., Lexington, Ky	J-3 Lyc. 55	1050 hr.	1000 hr.	875
Southern Arwys. Sales Co., Munic. Arpt., Birmingham, Alabama	J-3 Frnkln. 50	450 hr.	425 hr.	875
Krantz Aeronautical Service, Port Erie Airport, Erie, Pennsylvania	J-3 Frnkln. 50	800 hr.	Just	850
Dethloff Flying Service, Euclid Avenue Airport, Willoughby, Ohio	J-3 Frnkln. 50	450 hr.	65 hr.	850
Alabama Air Service, Auburn-Opelika Airport, Auburn, Ala	Trainer Lyc. 65	691 hr.	691 hr.	850
White Fly. Serv., Inc., Caldwell Wright Arpt., Caldwell, N. J	J-3 Lyc. 50	1275 hr.	8/40	850
McBoyle Cub Sales, Airport, Lake Delton, Wis.	J-3 Frnkln. 50	630 hr.	200 hr.	845
Inter-City Flying Service, Municipal Airport, Ft. Wayne, Ind	J-3 Frnkln. 50	347 hr.	Never	825
T. A. Culbertson, Airport, Medford, Oregon	J-3 Frnkln. 50	1200 hr.	250 hr.	800
Clinton A. Johnson, Box 864, Greensboro, North Carolina	J-3 Frnkln. 90	790 hr.	Just	800
McInnis Aviation Service, Inc., So. St. Paul Airport, So. St. Paul, Minn	J-3 Sport Frnkln. 50	735 hr.	204 hr.	800
James S. Campbell, Rolla, Mo	Trainer Frnkln. 50	600 hr.	Just	800
Jersey Flying Service, Inc., Oakland, N. J.	J-3 Frnkln. 60	600 hr.	100 hr.	795
Smith Fly. Serv., Wilkes-Barre Wyoming Valley Arpt., Forty-Fort, Pa	J-3 Cont. 50	1230 hr.	870 hr.	775
Skelly's Flying Service, Greenville Airport, Greenville, Pa	J-3 Lyc. 50	1000 hr.	Just	775
Susquehanna Air Service, 439 Broad Street, Montoursville, Pa	J-3 Lyc. 50	450 hr.	None	775
Alabama Air Service, Auburn-Opelika Airport, Auburn, Ala	Trainer Lyc. 55	1489 hr.	400 hr.	775
Rannells Air Service, Airport, Cumberland, Maryland	Trainer J-3 Lyc. 65	500 hr.	100 hr.	750
Brinckerhoff Flying Service, College Park Airport, College Park, Md	J-3 Lyc. 50	1500 hr.	105 hr.	750
Pierce Flying Service, Inc., Municipal Airport, Ft. Wayne, Indiana	J-3 Frnkln. 60	966 hr.	185 hr.	750
Elliott Flying Service, Clinton County Airport, DeWitt, Iowa	J-3 Lyc. 50	1100 hr.	150 hr.	750
Skelly's Fly. Serv., Greenville Arpt., Greenville, Pa	J-3 Lyc. 50	1100 hr.	Maj. Only	745
Jenkins Air Serv., Mun. Arpt., Rochester, N. Y.	J-3 Trainer Lyc. 50	1080 hr.	890 hr.	725
Hylan Flying Service, Inc., Rochester Airport, Rochester, N. Y	J-3 Cont. 50	1120 hr.	13 hr.	700
Rannells Air Service, Inc., Airport, Cumberland, Md	Trainer J-3 Frnkln. 60	800 hr.	200 hr.	700
Zimmerly Brothers Air Transport, Box 266, Lewiston, Idaho	Trainer Frnkln. 50	1600 hr.	150 hr.	700
Roy R. Taylor, Meacham Field, Fort Worth, Texas	Trainer Lyc. 55	1100 hr.	150 hr.	700
Jersey Flying Service, Inc., North Jersey Airport, Oakland, N. J	J-3 Frnkln. 60	600 hr.	100 hr.	695
Wallace Aircraft Co., Clarcona, Fla	J-2 Cont. 40	700 hr.	May '41	695
Oakland Arcft., Alameda, Calif	J-2 Cont. 40	1785 hr.	May '40	665
Bay State Flying Service, Framingham Airport, Framingham, Mass	J-3 Cont. 40	630 hr.	100 hr.	650
Pierce Flying Service, 2135 Broadway, Eureka, Calif	J-2 Cont. A-40	2050 hr.	110 hr.	600
Decatur Avia. Co., 776 S. Maffit St., Decatur, Illinois	J-3 Cont. 40	589 hr.	25 hr.	595
Seidner Fly. Serv., S.A.M. Arpt., Youngstown, Ohio	J-2 Cont. 40	396 hr.	90 hr.	579

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NATIONAL DISCOUNT CORPORATION

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SOUTH BEND, INDIANA

FLYING'S USED PLANE LISTING OF

DEALERS	MODEL AND ENGINE		TIME	TIME SINCE OVER-HAUL	PRICE
Aviation Market, L. A. Metropolitan Airport, Van Nuys, Calif.	J-3	Cont. A-40	625 hr.	185 hr.	$ 575
Piedmont Avia., Munic. Arpt., Winston-Salem, N. C.	J-3	Cont. 40	516 hr.	201 hr.	575
John Ruzicka, Circus City Arpt., Peru, Indiana	J-2	Cont. 40	550 hr.	50 hr.	575
John Ruzicka, Circus City Airport, Peru, Ind.	J-2	Cont. 40	550 hr.	50 hr.	550
Lexington Fly. Serv., Mun. Arpt., Lexington, Ky.	J-2	Cont. A-40-5	825 hr.		550
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.	J-2	Cont. 40	250 hr.		550
Piedmont Avia., Inc., Munic. Arpt., Winston-Salem, N. C.	J-2	Cont. 40	574 hr.	100 hr.	525
Linn County Airways, 221 3rd St., N.E., Cedar Rapids, Iowa		Cont. 40	400 hr.	5 hr.	525
Lane Aviation Corp., Port Columbus, Columbus, Ohio	E-2	Cont. 40	920 hr.		500
Linn County Airways, 221 Third St., N.E., Cedar Rapids, Iowa	E-2	Cont. 40	590 hr.	20 hr.	500
John Ruzicka, Circus City Airport, Peru, Ind.	J-2	Cont. 40	550 hr.	None	500
PITCAIRN					
Boulevard Airport, Inc., Roosevelt Boulevard, Philadelphia, Pa.	J67-240	Wright	345 hr.	Never	1695
Boulevard Airport, Inc., Roosevelt Blvd., Red Lion Road, Philadelphia, Pa.	Mailwing	Wright 250	500 hr.	100 hr.	1400
John Ruzicka, Circus City Airport, Peru, Ind.	P-6 Wright J-5 220		1200 hr.	100 hr.	795
PORTERFIELD					
Pierce Flying Service, Inc., Municipal Airport, Fort Wayne, Ind.		LeBlond 70	623 hr.	318 hr.	600
REARWIN					
Aircraft Sales of Michigan, Municipal Airport, Detroit, Mich.	Cloudster	Ken Royce 120	20 hr.	Never	4500
Aero Sales Company, 1008 First Nat'l. Building, Birmingham, Alabama	Cloudster	Ken Royce 120-125		Never	4000
C. W. Peterson, Mun. Arpt., Salina, Kansas.	Cloudster	KR 120	300 hr.	270 hr. Topped	3200
Aircraft Sales of Michigan, Municipal Airport, Detroit, Michigan	Skyranger	Frnkln. 80	New	Never	2700
Aircraft Sales of Michigan, Detroit City Airport, Detroit, Michigan	Skyranger	Cont. 75	New	Never	2575
Howard A. Morey, Box 529, Madison, Wisc.	Cloudster	Ken Royce 120	329 hr.	None	2500
Paris Fly. Serv., Mun. Arpt., Paris, Texas.	Skyranger	Cont. 75	125 hr.		2100
M. H. Wall, P.O. Box 327, Willoughby, O.	Skyranger	Cont. 75	35 hr.		1935
Jennings Bros., No. Grafton, Mass.		LeBlond 70	680 hr.	50 hr.	1075
E. W. Wiggins Airways, Inc., Boston Met. Arpt., Norwood, Mass.	8500	LeBlond 85	802 hr.	111 hr.	975
Southern Arwys. of Danville, Box 205, Danville, Va.	1936	LeBlond 85	368 hr.	Never	975
Racine Fly. Serv., Racine Arpt., Racine, Wisc.	7000	LeBlond 70	536 hr.	510 hr.	850
RYAN					
Standard Fly. Serv., Inc., Somerset Hills Arpt., Basking Ridge, N. J.	STA	Menasco 125	190 hr.	150 hr.	3450
SIKORSKY					
Mount Hawley Flying Service, Box 626, Peoria, Illinois	Amphibian	PW 330	402 hr.	75 hr.	5950
STANDARD					
A. A. Knowles, Rt. 4, Boise, Idaho	New	Wright J 5 220	417 hr.	3/40	1000
STEARMAN					
Stinson Fly. Corp., San Francisco Mun. Arpt., S. San Francisco, Calif.	Hammond	Menasco 150	500 hr.	10/40	1500
Tacoma Fly. Service, Box 157, So. Tacoma, Wash.	C-3-B	Wright J-5 220	1800 hr.	Recently	800
STINSON					
Max Conrad, Conrad Airport, Winona, Minn.	SR9B	Lyc. 245	1309 hr.	Never	7000
Thomas Oakes, 240 Belleville Ave., Bloomfield, N. J.	SR9BD	Lyc. 245	620 hr.	350 hr.	4500
Brinckerhoff Flying Service, College Park Airport, College Park, Md.	Rel. SR5-A	Lyc. 245	570 hr.	15 hr.	4100
Paul E. DePover, Marshall, Minn.	Voyager	Frnkln. 90	10 hr.		4000
Howard A. Morey, Box 529, Madison, Wisc.	"105"	Cont. 80	375 hr.	None	3500
Floyd Foren Flyers, Inc., Detroit City Airport, Detroit, Mich.	Voyager	Frnkln. 90	675 hr.	120 hr.	3400
Oak Air Service, Bates Field, Mobile, Ala.	"105"	Cont. 80	215 hr.	Just	2850
Detroit School of Aviation, Inc., Joy Airport, Fraser, Mich.	"105"	Cont. 80	189 hr.	Never	2750
Plow City Flying Service, Municipal Airport, Moline, Illinois	SR54	Lyc. 245	540 hr.	10 hr.	2650
Jenkins Air Serv., Inc. Mun. Arpt., Rochester, N. Y.	"105"	Cont. 80	215 hr.		2550
Moline Fly. Serv., Mun. Arpt., Moline, Illinois	SR-5A	Lyc. 245	850 hr.	760 hr.	2495
Boulevard Airport, Inc., Roosevelt Blvd. & Red Lion Road, Philadelphia, Pa.	"105"	Cont. 80	433 hr.	225 hr.	$2400
Jenkins Air Service, Inc., Municipal Airport, Rochester, N. Y.	"105"	Cont. 80	465 hr.	80 hr.	2400
Fred Eaton, 271 Seventh St., San Francisco, Calif.	"105"	Cont. A-80	270 hr.	Just	2000
Upton & Bowen, West Memphis, Ark.	"105"	Cont. 75	275 hr.	5 hr.	2000
Narragansett Avia. Serv., R. I. State Arpt., Hillsgrove, R. I.	SR 5	Lyc. 225	1350 hr.	10 hr.	1900
Barber's Flying Service, Municipal Airport, Pontiac, Michigan	"105"	Cont. 75	1048 hr.	150 hr.	1800
Leech Aircraft, Inc., Roosevelt Field, Hangar F, Mineola, N. Y.	"105"	Cont. 75	790 hr.	180 hr.	1750
Oak Air Service, Inc., Mobile Municipal Airport, Springhill, Alabama	SJR	Lyc. 215	1105 hr.		1450
Maheux's Airport, Inc., Stevens Mill Road, Auburn, Maine	SM8A	Lyc. 215	900 hr.	Just	1250
Cedar Rapids Airways, Inc., Box 183, Cedar Rapids, Iowa	SM8A	Lyc. 215	1235 hr.	Just re-covered fct. mjr.	1195
Livingston Airways Corp., Chapman Fld., Waterloo, Iowa	SM-8A	Lyc. 215	930 hr.	900 hr.	1000
DuBois Avia. Assoc., Munic. Arpt., DuBois, Pa.	S	Lyc. 215	1053 hr.	347 hr.	950
Lane Aviation Corporation, Port Columbus, Columbus, Ohio	SR	Lyc. 220	937 hr.	Never	800
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	SM-8A	Lyc. 215	850 hr.	820 hr.	800
Piedmont Aviation, Inc., Box 1941, Winston-Salem, N. C.	SM-8A	Lyc. 215	720 hr.	412 hr.	675
Leeward Avia., New Kensington, Pa.	SM-2	Warner 125	550 hr.	Yes	500
TAYLORCRAFT					
Southern Vt. Flying Service, Airport, N. Springfield, Vt.	BL12	Lyc. 65	75 hr.		2000
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	Deluxe	Cont. 65	225 hr.	Never	1900
Aviation Market, L. A. Metropolitan Airport, Van Nuys, Calif.		Cont. 65	30 hr.		1850
Inter-City Flying Service, Municipal Airport, Ft. Wayne, Ind.	'41 Deluxe	Cont. 65	100 hr.	Never	1850
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	Deluxe	Cont. 65	425 hr.	Never	1825
Hubert & Dillon Air Serv., Box 177-S, Tacoma, Wash.	BL Del.	Lyc. 65 dual	200 hr.		1825
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	Tandem	Cont. 65	40 hr.	Never	1800
Tailorcraft Aviation Corp., Alliance, Ohio		Lyc. 65-dual	140 hr.	20 hr.	1800
Inter-City Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.		Cont. 65	150 hr.	Never	1750
Wichita Falls Air Transp. Co., Box 84, Munic. Arpt., Wichita Falls, Tex.	BL-65	Lyc. 65	New	New	1750
Springfield Avia. Co., Munic. Arpt., Springfield, Illinois	BC-65	Cont. 65	195 hr.	None	1750
G. A. Short, Walnut, Illinois	Deluxe	Cont. 65	75 hr.	Never	1650
Washington Pk. Arpt., Homewood, Ill.		Cont. 65	150 hr.	None	1650
Lynchburg Air Trans. and Sales Corp., Preston Glenn Airport, Lynchburg, Va.		Cont. 40	400 hr.	Top-160	1650
Palmyra Arpt., 817 Lincoln Ave., Palmyra, N. J.	BL	Lyc. 65	138 hr.	Never	1625
Jesse Jones Air Service, Lancaster Municipal Airport, Lancaster, Pa.	BL	Lyc. 65	190 hr.	Never	1600
Dufort School of Aeronautics, Massena, N. Y.	BC	Cont. 65	491 hr.	32 hr.	1600
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	Deluxe BC	Cont. 65	950 hr.	Maj.now	1600
Roch. Aeron. Corp., Roch. Arpt., Roch., N. Y.	BL-65	Lyc. 65	80 hr.		1525
Narragansett Avia. Serv., R. I. State Arpt., Hillsgrove, R. I.	BL-40	Lyc. 65	254 hr.	Will be	1495
Plow City Flying Service, Municipal Airport, Moline, Illinois		Lyc. 65	1435 hr.		1450
Plow City Flying Service, Municipal Airport, Moline, Illinois	BL	Lyc. 65	1070 hr.	73 hr.	1450
C. R. Galloway, 707 W. Groud, Ponca City, Oklahoma	BC	Cont. 65	600 hr.	35 hr.	1450
Ranger Fly. Serv., Ranger, Texas	BL-65	Lyc. 55	140 hr.	140 hr.	1450
Moline Fly. Serv., Munic. Arpt., Moline, Ill.	DeLuxe BL	Lyc. 65	675 hr.	None	1400
Palmyra Arpt.,817 Lincoln Ave.,Palmyra, N. J.	BL	Lyc. 65	318 hr.	Never	1400
Ranger Fly. Serv., Munic. Arpt., Ranger, Texas	BL-65	Lyc. 55 dual	170 hr.	170 hr.	1395
Washington Park Arpt., Inc., Homewood, Ill.		Lyc. 50	83 hr.	None	1390
Max Conrad, Conrad Airport, Winona, Minn.	Deluxe	Lyc. 65	738 hr.	None	1350
Ranger Fly. Serv., Ranger, Texas.	BL-55	Lyc. 55	180 hr.	180 hr.	1350
Inter-City Fly., Munic. Arpt., Ft. Wayne, Ind.	BL '40	Lyc. 50	326 hr.		1325
Lane Avia. Serv., Pt. Columbus, Columbus, O.		Lyc. 65	428 hr.	Never	1300
Walter D. Mauk, Municipal Airport, Blackwell, Okla.		Lyc.	600 hr.	n'w eng.	1300
Greenville Sch. Avia., Treaty City Arpt., Greenville, Ohio	BL	Lyc. 65	265 hr.	None	1300
Hopewell Fly. Serv., Hopewell Arpt., Hopewell, Va.	BL-65	Lyc. 65	375 hr.	9/40	1300
Aviation Market, L. A. Metropolitan Airport, Van Nuys, Calif.	BL-65	Lyc. 65	480 hr.		1250
J. E. Badger, 1780 Green Road, S. Euclid, O.	B	Cont. 65	400 hr.		1200
J. E. Badger, 1780 Green Rd., S. Euclid, Ohio	FTB	Cont. A65	410 hr.	20-top	1200
Marlboro Airport, Inc., Farm Road, Marlboro, Mass.	Trainer	Lyc. 55-dual	772 hr.	142 hr.	1200

AUTHORIZED AIRCRAFT DEALERS

DEALERS	MODEL AND ENGINE		TIME	TIME SINCE OVER-HAUL	PRICE
Rochester Aeron. Corp., Rochester Airport, Rochester, N. Y.	BL-55	Lyc. 55	500 hr.	None	$1200
Lloyd E. Daniels, Crete, Illinois	Deluxe '39	Cont. 65	1000 hr.	Just	1195
C. W. Peterson, Munic. Arpt., Salina, Kans.	BLT-65	Lyc. 65	290 hr.	Never	1195
Boyd Mote, Denman Ave., Coshocton, Ohio	BL-50	Lyc. 50	105 hr.	New 1940	1195
Dufort Sch. Aero., 57 Ft. Covington St., Malone, N. Y.	BT	Lyc. 55	395 hr.	New 5/40	1175
Lane Aviation Corporation, Port Columbus, Columbus, Ohio	DL 65	Lyc. 65	700 hr.	Never	1100
Dufort School of Aeronautics, Massena, N. Y.	BLT	Lyc. 55	805 hr.	231 hr.	1100
Harry C. Phillips, Phillips Flying Service, Mt. Pleasant, Mich.	BLT	Lyc. 50	500 hr.	Never	1100
Palmyra Arpt., 817 Lincoln Ave., Palmyra, N. J.	BLT	Lyc. 50	373 hr.	83 hr.	1100
Duane L. Huscher, Box 65, Lawton, Oklahoma	Deluxe	Cont. 65	2028 hr.	135 hr.	1050
Ryan Air Serv., Decorah, Iowa	Late '39	Lyc. 50	770 hr.	350 hr.	1050
Wichita Falls Air Transp. Co., Box 84, Munic. Arpt., Wichita Falls, Texas	BLT-55	Lyc. 55	400 hr.	Since 50 hr.	1050
Phillips Fly. Serv., Arpt., Mt. Pleasant, Mich.	BL-50	Lyc. 50	1100 hr.	900 hr.	1050
Merrill Hale, Hillsgrove, R. I.		Frnkln. 50	268 hr.	35 hr.	1050
Duane L. Huscher, Box 65, Lawton, Oklahoma	BLT	Lyc. 65	1550 hr.	600 hr.	1000
Hyannis Airport Corporation, Box 592, Hyannis, Mass.	BLT	Lyc. 55	1170 hr.	225 hr.	1000
Louis A. Musgrove, Box 814, Morgantown, W. Va.	BL	Lyc. 50	725 hr.	150 hr.	1000
Cliff Ryan, Box 82, Muscatine, Iowa	BL	Lyc. 50	650 hr.	300 hr.	995
Canton Aviation Co., Martin Field, Canton, O.	BLT	Lyc. 65	1000 hr.	200 hr.	995
Canton Aviation Co., Martin Field, Canton, O.	BLT	Lyc. 65	950 hr.	100 hr.	995
Narragansett Avia. Serv., R. I. State Arpt., Hillsgrove, R. I.	BF	Frnkln. 50	351 hr.	130 hr. Since	995
Washington Park Airport, Homewood, Ill.	BL	Lyc. 50	950 hr.	300 hr.	950
J. W. Hunt, 636 N. Livinstone St., Lexington, Kentucky		Cont. 65	525 hr.	25 hr.	950
Schneider Aero. Serv., Chandler Fld., Fresno, Calif.	BC	Cont. 50	1216 hr.	106 hr.	950
Max Conrad, Conrad Airport, Winona, Minn.		Lyc. 50	1020 hr.	None	900
Walter D. Mauk, Municipal Airport, Blackwell, Oklahoma		Cont. 50	782 hr.	150 hr.	900
Jesse Jones, Munic. Arpt., Lancaster, Pa.		Lyc. 55	950 hr.	50 hr.	875
Piedmont Avia., Munic. Arpt., Winston-Salem, N. C.	'39	Frnkln. 50	563 hr.	164 hr.	825
Lane Aviation Corp., Port Columbus, Columbus, Ohio		Lyc. 50	1700 hr.		800
Hume Flying Service, Box 551, Arkansas City, Kansas		Cont. A-40-4	1032 hr.	Just	700
Carnahan Fly. Serv., Bloomington, Ill.		Cont. 40	507 hr.	100 hr.	700
Niederhauser Airways, 104 South 5th St., Marshalltown, Iowa	A	Cont. 40	710 hr.	280 hr.	695
Merrill Hale, Hillsgrove, R. I.		Cont. 40	1081 hr.	100 hr.	695
Virginia Cub Distributors, Box 211, Farmville, Virginia		Cont. 40	500 hr.	Just	670
Lynchburg Air Transport & Sales, Preston Glenn Airport, Lynchburg, Va.	'38	Cont. 40	415 hr.	Never	650
Cedar Rapids Airways, Inc., Box 183, Cedar Rapids, Iowa		Cont. 40	1006 hr.	Just	650
Springfield Avia. Co., Munic. Arpt., Sprgfld., Ill.		Cont. A-40-4	375 hr.	None	650
J. L. Wells, 106 W. Main, Avon Park, Fla.		Cont. 40	690 hr.	100 hr.	650
E. H. Brockenbrough, Munic. Arpt., Charlotte, N. C.	A	Cont. 40	550 hr.	520 hr.	600
Air Activities, Inc., Municipal Airport, Houston, Texas		Lyc. 50	1500 hr.	500 hr.	550
Canton Aviation Co., Martin Field, Canton, O.		Cont. 40	420 hr.	30 hr.	525

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Indiana Air Serv., Inc., Bendix Fld., So. Bend, Indiana	4000	Wright J-5, 220	940 hr.	7/40	1200
Louis A. Musgrove, Airport, Elkins, W. Va.	BL-T	Lyc. 65	600 hr.	200 hr.	1200
H. E. Oliver, 63 Orchard St., Pittsfield, Mass.	BL	Lyc. 55	450 hr.	Top 400 hr.	1200
Lynchburg Air Transport and Sales, Preston Glenn Airport, Lynchburg, Va.	4000	Wright J5A	350 hr.	30 hr.	1100
Cedar Rapids Arwys., Inc., Cedar Rapids, Ia.	4000	Wright J6A	12 hr.	Since	1050
Shaw Arcft. Co., Munic. Arpt., Iowa City, Ia.	4000	J-5, 220	1401 hr.	511 hr.	1000
Oak Air Service, Inc., Mobile Municipal Airport, Springhill, Ala.	E4000	Wright J-6-5	1142 hr.		950
McInnis Aviation Service, Inc., McInnis So. St. Paul Airport, So. St. Paul, Minn.	B4000	Wright J5	1712 hr.	102 hr.	895
McInnis Aviation Service, Inc., So. St. Paul Airport, S. St. Paul, Minnesota		Lyc. 65	1263 hr.	11 hr.	1050
McInnis Aviation Service, Inc., South St. Paul Airport, S. St. Paul, Minn.	B4000	Wright J-5, 220	1712 hr.	120 hr.	879
Leeward Aviation, Vandergraft Airport, New Kensington, Pa.	4000	Challenger 185	700 hr.	16 hr.	750
Leeward Avia., New Kensington, Pa.		Chall. 185	700 hr.	Yes	745
VERVILLE					
Oak Air Service, Inc., Mobile Municipal Airport, Springhill, Alabama	AT31	Cont. 165	394 hr.	Just	900
WACO					
Max Conrad, Conrad Airport, Winona, Minn.	UPF-7	Cont. 220	788 hr.	None	5000
W. Arnet Speer, 2830 Pacific, San Diego, Calif.	UPF-7	Cont. 220	1200 hr.	175 hr.	4750
Safair, Inc., Roosevelt Field, Mineola, N. Y.	YMF	Jacobs 225	1330 hr.	20 hr.	2995
Washington Park Airport, Homewood, Ill.	YKS-7	Jacobs 225	401 hr.	91 hr.	2975
M. E. Hale, Tri-Cities Airport, Endicott, N. Y.	UKC	Cont. 210	700 hr.	Never	2500
Merrill R. Hale, Tri-Cities Airport, Endicott, N. Y.	UKC-S	Cont. 210	700 hr.	Never	2500
Barber's Flying Service, Municipal Airport, Pontiac, Mich.	YKS	Jacobs 225	592 hr.	10 hr.	2500
Howard G. Mayes, Box 2104, Huntington, W. Va.	Custom	Jacobs 225	834 hr.	35 hr.	2500
Air Activities, Inc., Municipal Airport, Houston, Texas	YKS	Jacobs 225	700 hr.	150 hr.	2250
Roy R. Taylor, Meacham Field, Fort Worth, Texas	F	Warner 125	575 hr.	Just	2250
Jesse Jones, Municipal Airport, Lancaster, Pa.	RNF	Warner 125	700 hr.	20 hr.	1500
Plow City Flying Service, Municipal Airport, Moline, Illinois	RNF	Warner 125	879 hr.		1450
Lane Aviation Corp., Port Columbus, Columbus, Ohio	INF	Kinner 125	575 hr.		1350
Conn. Flyers, Inc., Bethany Airport, Bethany, Connecticut	RNF	Warner 125	580 hr.	200 hr.	1300
Leeward Aviation, Vandergraft Airport, New Kensington, Pa.	UIC	Cont. 210	800 hr.	180 hr.	1295
Pierce Flying Service, Inc., Municipal Airport, Ft. Wayne, Ind.	RNF	Warner 125	902 hr.	287 hr.	1250
J. C. Gendron, 220 E. Coolidge, Ironwood, Michigan	RNF	Warner 125	1100 hr.	300 hr.	975
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(*Continued from page* 106)

as many travelers, and at 3,000, half as many as at 2,000. Computing the several hundred collections made around Tallulah, it has been found that in a column of air one mile square there is an approximate average of 25,000,000 insects under all conditions at all times of the year. The lowest ebb is 12,000,000 in January and the highest in May, when there are 36,000,000 insects per square mile of air. The pink bollworm moth, which had been marked as a weak flyer with a tendency to stay grounded, has been discovered by airplane catchers to be lurking 3,000 feet above ground.

All of these findings have a most important relation to many of the problems of insect repression or control. There is no doubt that the use of airplanes has thrown an entirely different light on the manner and method of travel of many insects species and the spread of infestations.

The entomologists now hope to make collecting flights along the Gulf Coast. It is known that moths migrate each season from countries to the south, and it is expected that the air traps will be able to swoop down upon them and learn the source of their infestations and the routes taken. In this way too, important records can be made of other tropical economic insects, such as the pink bollworm moth, the Mexican and Mediterranean fruitflies and the cotton leaf worm moth.

There is one phase of bug catching by airplanes not lauded by science. This concerns the carrying of injurious insects and plants from foreign countries and Hawaii. Insects find shelter in the cockpit, fuselage or cabin of an airplane. Beetles, carabids and staphylinids are always found, and leafhoppers are common stowaways. It is noteworthy that in 3,150 airplanes arriving from foreign countries and Hawaii there were 916 interceptions of prohibited plant materials and insects. Quarantine stations at our international airports have taken an active interest in this menace and, according to reports, have the situation well in hand.

END

Airy Chat

(*Continued from page* 4)

20). Shortly thereafter an airmail-special arrived containing a hot new article on the CAP; it was one of the articles we'd hopefully scheduled for this issue, but which didn't develop into its finished form until it was just too late to start tearing things up. Yesterday? Well, we had the story of Plexiglas all ready to run—type set, captions written, proofs out. Then a long distance phone call informed us that the story would be incomplete without important additional material which couldn't be supplied us until the deadline had passed. So out came the article, another was substituted within an hour, and the mad rush proceeded. . . .

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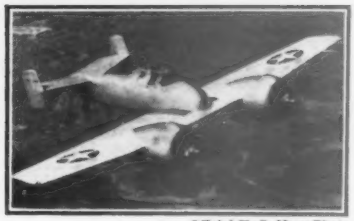

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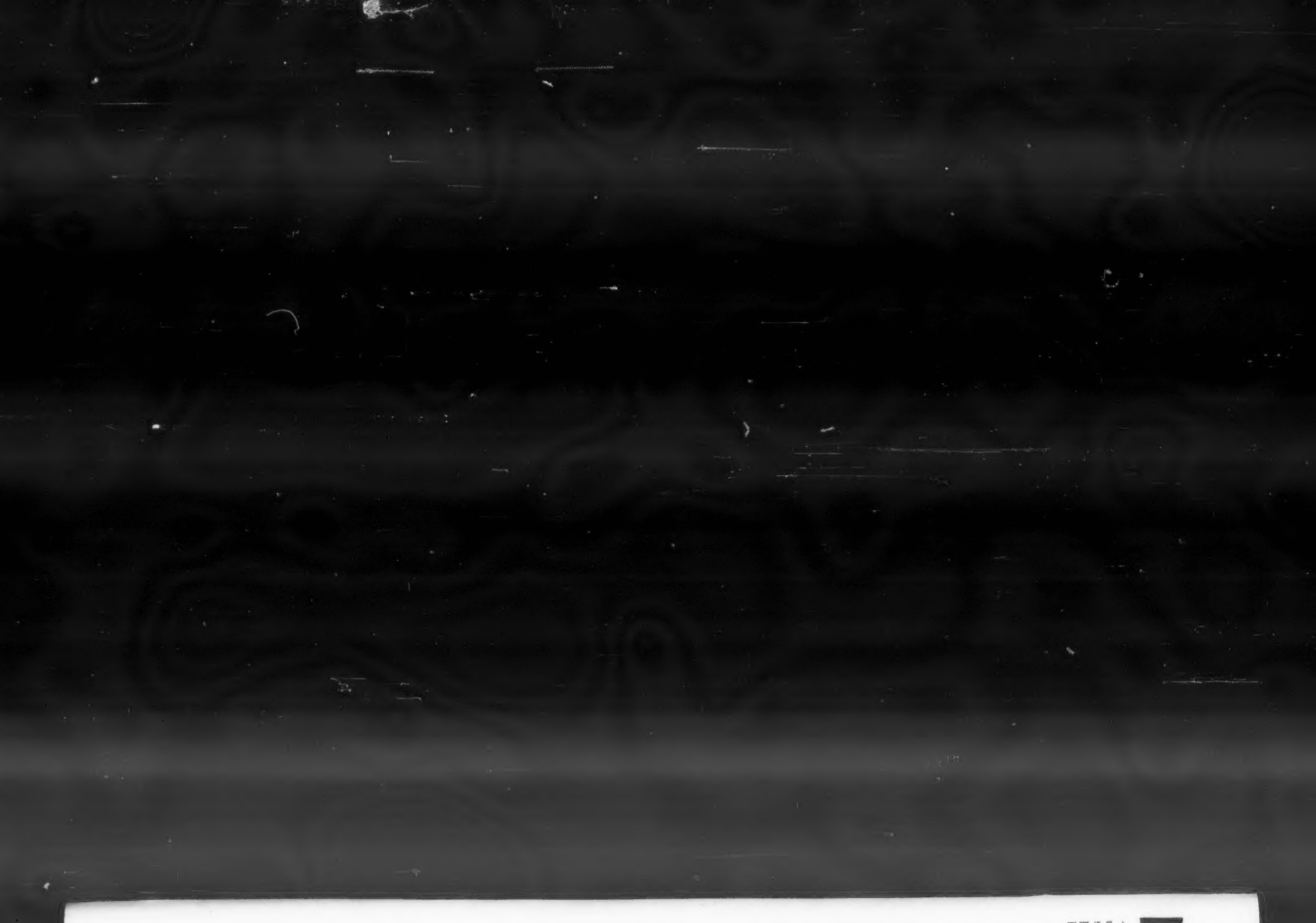

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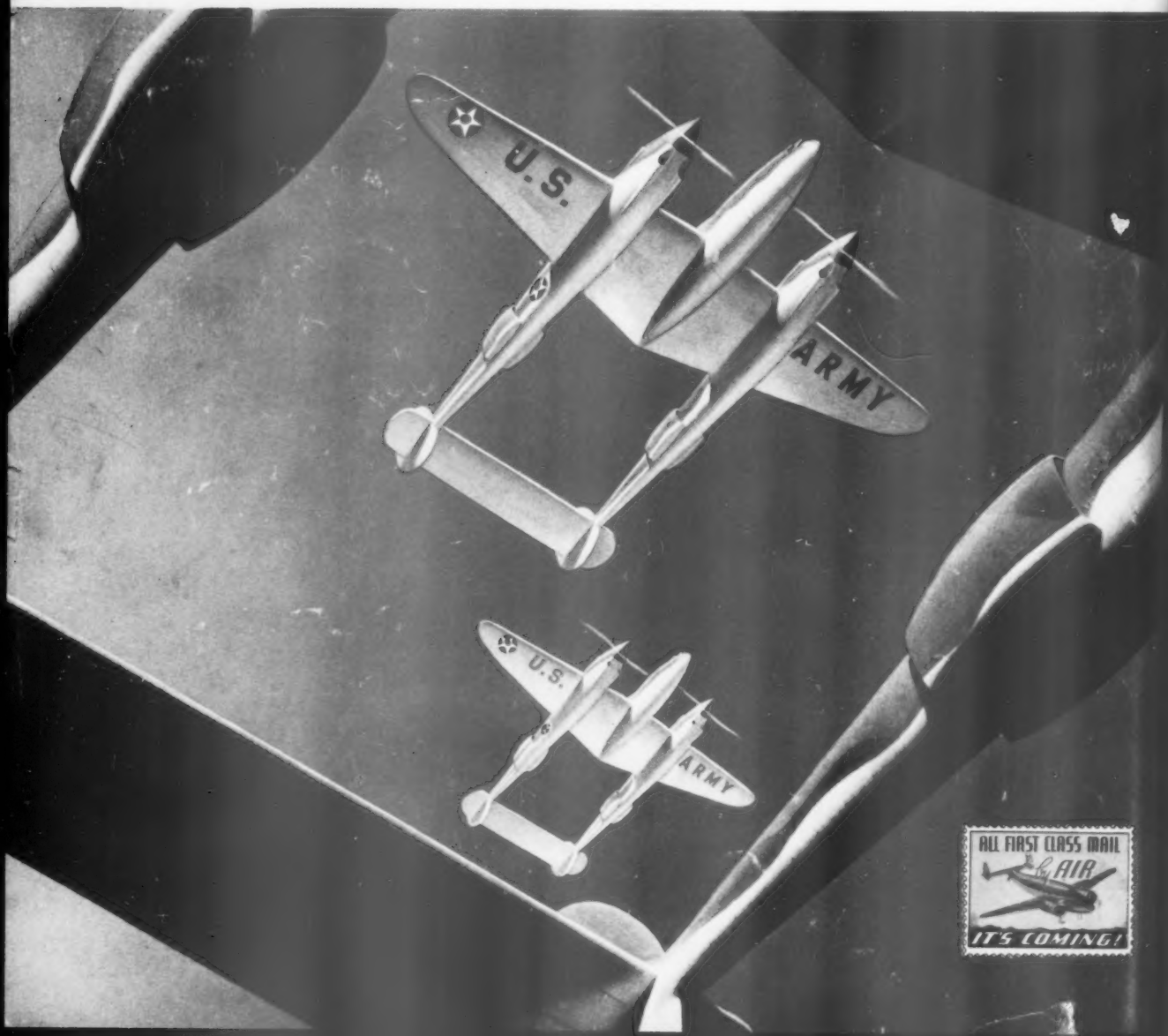
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